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[OFFICIAL NOTICE.]

Twenty-first Annual Meeting, Western Gas Association.

OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 6, 1898.

To the Members of the Western Gas Association: The twenty-first annual meeting of the Western Gas Association will be held at Detroit, Mich., May 18, 19 and 20, 1898, and will be called to order by the President, Mr. James T. Lynn, at 9:30 A.M., Wednesday, May 18.

The Russell House has been selected as headquarters, and the sessions will be held in a suitable room contained therein. The proprietors of the Russell House have agreed to fix these rates for the Association: Room, without bath, from $3 to $3.50; with bath, from $3.50 up.

The Executive Committee has arranged for the presentation of the following papers:

"The Enrichment of Coal Gas," by Mr. George H. Harper, Altoona, Pa.

"The Use of Gas for Purposes other than Lighting," by Mr. C. W. Blodget, Brooklyn, N. Y.

"The Igniting of Gas by Static Electricity," by Mr. Bankson Taylor, St. Paul, Minn.

"Recent Developments in Texas of Interest to the Gas Man," by Mr. Thos. D. Miller, Dallas, Tex.

"Methods of Estimating the Values of Gas Liquors," by Mr. O. O. Thwing, St. Louis, Mo.

"The Prepayment Meter," by Mr. C. H. Raynor, Adrian, Mich.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N. Y.

"Some English Correspondence upon Isolated Generators for Bench Firing," to be read by Mr. G. Treadway Thompson, New York City.

The Michigan Passenger Association, the Trunk Line, the Central Passenger Association, the Southern Passenger Association and the Western Passenger Association, from points in Eastern Committee and Trans Missouri Committee territories, have granted rates of 1½ fare for the round trip, conditional on the presentation to the Secretary of 100 certificates for indorsement. The territory covered by the above Associations includes all States east of the Missouri and Mississippi rivers, except the New England States. It is further to be noted that the reduced rate applies to the following States and Territories west of the Mississippi and Missouri rivers: Kansas, Nebraska, Colorado, Utah, Wyoming, Oklahoma, Indian Territory and Missouri.

All persons attending the meeting should purchase a first-class ticket at starting point, paying full fare for same and obtaining from the agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Detroit, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser thereof to a one-third rate, returning home.

All persons obtaining reduced rates must apply to agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but the certificates may be obtained on request,

provided the notification is made in time. Persons outside the territory covered by the Passenger Associations named above should purchase a ticket to nearest point within said Associations' districts, and from there purchase a ticket to Detroit, obtaining a certificate entitling them to a one-third fare returning to the place from which the certificate was obtained. The Western Passenger Association for the first time has granted reduced rates, on the certificate plan, from territory east of the Missouri river and west of Chicago, Peoria and St. Louis. It is to be hoped that this will induce members in the territory named to attend the meeting, and that it will influence other gas men not members to join our Association.

Do not travel to Detroit on mileage tickets; it is just as cheap to obtain a certificate. Nearly one-fourth of those who attended our meetings the last few years used mileage books, which practice interferes in extending the territory in which reduced rates are obtainable.

All queries sent to the Secretary for the Question Box will be assigned to members for answers.

A cordial invitation is extended to members of other Associations to meet with us and to participate in the discussion of papers presented.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail applications to those who desire to become members of the Association.

JAMES W. DUNBAR, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, Pacific Coast Gas Association.

MERCED, CAL., March 11, 1898.

To the Members of the Pacific Coast Gas Association: At the last meeting of the Pacific Coast Gas Association to me was delegated the duty of collecting and presenting any matter, in the shape of original ideas or special devices, which may come under the head of "Wrinkles," to be presented in proper form for the benefit of the Association at the next regular assembly.

Many of our members having charge of gas plants on the Coast have many plans, that are practical, handy and labor-saving, which many others by force of circumstances have never seen, but who, on presentation of the device, drawn and described, or through the medium of our official organ (the AMERICAN GAS LIGHT JOURNAL), would gladly embrace the opportunity, and put into practice a plan very beneficial—which perhaps had been in use in some obscure place many years, used exclusively by one man—that would, when given daylight, benefit the whole gas fraternity.

On reading this communication, please see if you have not forgotten something in the shape of a "Wrinkle," that is doing good service in your works, that would be of great importance to the Association. Your answer to this will greatly oblige.

GEORGE H. HOLLIDGE,
Editor "Wrinkle" Department.

BRIEFLY TOLD.

A NEW OLD CHARTER.—Of many revealments there is no end; so it must be with great pleasure that the proprietors of the Newark (N. J.) Gas Light Company have awaked to the fact that that which their successors thought counted not for much is still in their possession. Particularly must this apply to the officers of the old Newark Company, since it was in their care that the old documents were carried. The sequel to the story is that which is told in our current item columns, where may be found the terms of the charter, granted in 1873, to the projectors of the Oxy-Hydrogen Company, of the United States. In some cases age brings, or carries, strength; and the current sample goes to show that the Vanderpool of 1898 is about as strong as was the Vanderpool of 189–, when the old Newark Gas Light Company was sold to Mr. Kelsey and his compatriots. The dispute or contention for the control of the ultimate gas supply of central-middle New Jersey is quite interesting at the present time, and the revival or rejuvenation of the Oxy-Hydrogen Company's charter, of April 4th, 1873, furnishes one more example of the truth of the mixed adage that those who are fittest will survive. The survival may be Kelsey, but from our point of view the survival will be Vanderpool.

SOME RETURNS.—Putting one thing against another, and making up our minds from that which is reported to us, the fortunate conclusion is that the gas men of the States have small fault to find with their state of trade. On every hand we have reports of gains, with the section close by reporting the greatest increases. Of course, the comparisons are made regarding the first three months of 1897 as against the corresponding months of this year. The large cities show marked increases; New York and Boston leading, with Baltimore and the Ohio river cities well up. To put it shortly, 37 places reporting show an average gain, amounting to 10.72 per cent. A fair look over the situation cannot fail to convince the careful observer that the state of trade in the gas business is steadier and brighter than since the unfortunately noted year of 1893.

NOTES.—At the annual meeting of the Media (Pa.) Gas Company the following officers were elected: Managers, F. M. Brooke, C. F. Williamson, H. P. Green, W. F. Campbell and Hunter Brooke; President, Benjamin Brooke; Treasurer, Edward H. Hall.——The Massachusetts Legislature seems inclined to increase the salaries of the present Board of Gas and Electric Light Commissioners in the sum of $500 each. From our point of view the addition asked by the Commissioners was not a cent more than their services were worth.——We understand that Mr. Ernest C. Brown has completed negotiations, or that he has assisted in forwarding negotiations to a completion, under which the gas interests of Wilkes-Barre, Pa., are to be completed, and submerged.——The new holder for the Winnipeg, Manitoba, Company is completed.——The Universal Company, of Chicago, has added largely to its real property.

A Novel Form of Thermo-Electric Battery.

The *Electrical World*, in editorial comment on a paper read by Mr. C. J. Reed, before the American Institute of Electrical Engineers, says that the paper described experiments tending to show a thermo-electric force between metals and heated electrolytes enormously greater than any other known thermo-electric action. The main experiment described and shown consisted in plunging two steel rods into a mass of fused alkali, one rod having a recess or groove turned into it in such a way as to reduce the conduction of heat and thereby render its immersed part hotter than the immersed end of the other solid rod in which the conduction and consequently the dissipation of heat to the air above was more rapid. An E.M.F., varying apparently with the difference of temperature between the two rods and also changing with the absolute temperature of the liquid, amounting at times to one volt, can be obtained by such a combination. It was argued that this was a thermo-electric action rather than an electro-chemical one, as the latter could not be consistent with the law of the conservation of energy, this argument in detail being as follows in the words of the writer of the paper:

"Admitting that the chemical affinity between hot iron and the electrolyte is undoubtedly different from that between cold iron and the electrolyte, no energy could be evolved in any form due to this differential affinity, except energy derived from the heat of the furnace, since the existence of this differential affinity depends only upon the difference in temperature. To suppose that the electrical energy of this cell is derived from chemical action involves the assumption that iron has a greater affinity than iron for oxygen, or that oxygen will select and combine with one of two similar pieces of iron while it dissociates from the other, and the further assumption that such a process will evolve energy.

"If this is possible, it can be possible only because of the difference in temperature, which in turn can be maintained only by a constant expenditure of heat from the furnace. Otherwise we should have an inexhaustible source of energy. If oxygen can evolve energy by leaving one piece of iron and combining with another, it may, with equal reason, leave the second and re-combine with the first, evolving an equal amount of energy, and there would be no limit to the number of such reversals, all evolving energy."

This line of reasoning was disputed in the discussion, particularly by Mr. Charles P. Steinmetz, who argued that the iron being oxidized at one temperature and reduced at another, considered in connection with the difference in specific heat between iron and oxygen and their combination, would allow of what might be called a thermo-chemical cycle, by which the heat would be absorbed and electricity finally delivered, the intermediate action being chemical.

Thus the iron and the oxygen, on being heated from the temperature of the cooler junction to that of the hotter, would absorb more heat than would be again given out by the oxide in cooling from the temperature of the hotter junction to that of the cooler, thus allowing for the production of electric power without any violation of the law of the conservation of energy.

Address of the President (Mr. R. Beynon, of Torquay, England), Last Annual Meeting, Southern District Association of Gas Engineers.

Gentlemen: I must first of all thank you again most heartily for having placed me in this proud position. I must confess that when I first heard my name mentioned in connection with this post, serious misgivings arose in my mind as to my fitness and ability to occupy it with any degree of success—especially so as I have to follow one who has filled the chair with such conspicuous ability and tact. However, having allowed myself to be over persuaded, I address myself to this great task, resolving to take as my motto "Nil desperandum," and trusting to each individual member to make my work as light as possible, and to be lenient in judgment.

I would commence by stating that I have no new process to bring to your notice, nor the results of any experiments to offer for your criticism; but I hope to interest you with several experiences that I have met with since being in charge of my present works. My time has been so fully taken up with extensions and improvements in the various departments that, until this year, I have had very little time for the prosecution of such experiments.

The Torquay Gas Works.—Seeing that the works under my charge are so little known to any of you, a very brief description of them may not be inappropriate. They are situated on the shores of Torbay, and in one of the most beautiful parts of the bay, about midway between Torquay and Paignton, close by the Great Western Railway's branch line to Kingswear, from which a siding runs alongside the coal stores, the floors of which are 10 feet below the rail level. They are three in number, and hold about 4,000 tons, when full. There are two retort houses, distinguished as the old and new; engine and boiler house; scrubbers, 40 feet high and 9 feet diameter; Laycock's washer scrubber; four 20-feet square purifiers; no less than four holders; and our annual make amounts to 146,000,000 cubic feet. Turning now from cursory description of the works, and going back to the coal stores, you will see that we are fortunate in being able to store a large amount of coal under cover; the quantity being about eight weeks' stock, at our maximum consumption of 75 tons per diem. Situated, as we are, a long distance from the coal fields, and depending on water carriage, this is by no means too large a stock to have on hand; for on one occasion we were reduced, owing to continuous heavy weather, to within five days' consumption. On the other hand, the storage of this amount of coal is not without its anxieties, owing, of course, to the liability of spontaneous combustion. On one occasion only has this occurred—and this was in the winter after I was placed in charge—though at several times there has been a considerable rise in temperature. The cause of this coal firing was as follows: The cellar in which it was placed had been excavated about 3 feet below the level of the others, and though a pipe had been placed to act as a drain it had become choked. It thus allowed the water to rise; and the natural result fol lowed. This cellar has since been brought up to the level of the others. I now make it a rule to thrust iron rods into the heaps, which are withdrawn at stated times and the temperature tested. This, at any rate, is a rough and ready means of guarding against any undue rise in the temperature, and so enables the manager to avoid one of the most unpleasant experiences that can fall to his lot.

I see it has been suggested that the best way to secure oneself against the evil results of a coal strike, or adverse elements, would be to store in the open, say, eight week' consumption calculated on the maximum daily amount carbonized, which should only be drawn from on an emergency arising. With Newcastle unscreened coal containing as it does a large amount of small, I should be afraid to try this plan; but it might answer with screened coal, though I should think, even then, there would be a very considerable diminution in the results obtainable.

Klonne's Regenerators.—Finding that our carbonizing plant in 1894 was too small for the demands made upon it, we determined to build a new retort house; and after much consideration we decided to erect one with a stage floor. It was commenced in March of the following year, and finished by about the middle of December; and it was furnished with Klonne's regenerative furnaces, from drawings supplied by Mr. R. O. Paterson, of Cheltenham. There are six benches, of eight retorts each, 20 feet through, fired on one side only, as usual. The retorts are fitted with self sealing mouthpieces, with dished steel lids. The ascension, bridge and dip pipes are 5 inches in diameter; and the hydraulic mains are quarter circle in section, and in separate sections, fitted with combined weir and tar valves (of which more hereafter). There are the usual tar and foul mains. The house is also fitted with West's coal breaking, elevating and conveying machinery, driven by an Otto gas engine, and drawing and charging machines for manual labor. The total cost of the building, retort benches, two chimney stacks and machinery, worked out to about $400 per mouthpiece. This is rather high, but seeing the distance we are from the firebrick and iron centers and taking into consideration the fact that we were pressed for time, the amount cannot be considered an unreasonable one. If, however, I had to do the work again, I should proceed on rather different lines. For one thing, I would not have five or six separate contractors to do the work; for though it may be slightly cheaper, it entails no end of anxiety for the company and their engineer, besides being difficult to fix blame on either one of them for delays.

Struggles with Stopped Pipes.—As I have said, we finished the house in the middle of December, and immediately started to work. After we had mastered the method of manipulating the various dampers, we proceeded for some time working very comfortably, and found the benches easy to heat regularly, and very economical in the consumption of coke. This state of affairs lasted for about six months, and then we began to experience the nuisance of stopped ascension pipes. We tried all sorts of remedial measures—such as lowering the heat, protecting the ascension pipes from the radiant heat of the benches, placing wet ashes on the mouthpieces—but nothing seemed to afford us any relief; and so matters drifted until just before Christmas, when it was no uncommon thing to go into the retort houses and see whole benches blazing around the mouthpieces.

It was just about the same time that a letter appeared in the *Journal of Gas Lighting*, asking for help, or rather advice, for one who was in a similar predicament; and though the inquiry did not emanate from me, it might well have done so. The replies, it will no doubt be within your recollection, were many and varied; and among them was one from M. Irminger, of Copenhagen, suggesting the coating of the retort for about 1 or 2 feet inside the mouthpiece with a stiff wash of fireclay, and giving his reasons for this procedure. It seemed reasonable, and so I determined to give it a trial on the following day. That night I went to bed with a light heart, thanking M. Irminger for his remedy, and resolving to write the *Journal* next day giving the result of the experiment. Never a stopped pipe the whole day. But, on going into the retort house next morning, I found matters just as bad, if not worse than before; so the letter was never written.

Still, something had to be done; so, taking advantage of the Sunday stop, we removed the whole of the handhole covers of the hydraulics to examine the state of things there. They appeared at first sight to be in order, the dip pipes being sealed in an inch of liquor. But further examination showed that there was a lot of thick tar at the bottom. The weir valves, I should say, were constructed with a screen in front of them, so as to cause the tar to flow away first, thus insuring that the dip pipes should be sealed in liquor only. This is, no doubt, an excellent theory, and one that would work well with tar of a lighter sort than that obtained from Newcastle coal. I had cause, however, to think that this action did not take place; for though everything appeared right, the benches had stopped for a period of four hours before they were opened, and the liquor thus had had time to resume its normal level. An examination the day before by gauge, when working, had shown a seal of from 2 to 2½ inches. The hydraulics were cleaned out and refilled with ammoniacal liquor, and we found a decided improvement in the working next day. As a temporary measure, therefore, I procured a large hose and flushed out the mains every day. This was better, and we managed to go on to the spring, when I resumed working in the old house. I then had all the ascension pipes taken down to give them a thorough clean out. They presented a sorry sight, some of them having barely a 2-inch hole through them, and the deposit round the pipes so hard that it was only with considerable difficulty we succeeded in clearing them. I also took out the dips and shortened them an inch, so as to insure working with a lighter seal, and laid on a supply of ammoniacal liquor to each section of the mains, and then restarted working them.

All this work, however, has not quite removed the difficulty, for we still suffer to some extent. The coal we mostly use is New Pelton unscreened, which contains a large proportion of dead small; and this is, no doubt, greatly increased by passing through the breaker and other machinery. Therefore, when put into the retort, a large quantity of this dust is carried off with the first rush of gas, and takes the earliest opportunity of depositing itself, along with the heavier tar, on the sides of the ascension pipes. Working with about the same heats and seals in the old retort house, we never experienced anything like the trouble. This seems to confirm the view taken by our late Presi-

dent of the cause of these stoppages—viz., that it is owing to the rapidity with which the charge is put in and the door closed.

Dredging a Tar Well.—While on the subject of this house, there is another circumstance which may be interesting to you, and that is the change which I have observed takes place in the character of the tar. The gas from the house is taken away by an 18-inch steel foul main connected to the 24-inch steel main in the old house, and thence by an 18-inch cast iron main to the condensers, which are annular; so that, altogether, it travels about 400 feet before entering these. Well, sometime after commencing to carbonize coal in this new house, we observed that the tar which ran down over the sides of the seal cups into the trough in front of the condensers commenced to leave a deposit of a very gritty nature, and also that the tar in the trough became coated over with a crust similar to a thin coating of ice on water. From the fact of its being easily melted by steam, it must be a formation of naphthaline mixed with a proportion of extremely fine dust; but it is never observed when we are working in the old house. This is rather a disquieting incident, insomuch that I find the bottom of our new tar tank is covered with a tough, pasty deposit, which chokes up the strainer of the suction pipe belonging to the tar pump.

Speaking of tar wells reminds me that we had, in our old one, a practical experience of the unwisdom of allowing the water from the lime purifiers to drain back there. It had been allowed to do so for some time, until an increasing difficulty was reported to me of filling the contractor's tar tanks, though at the same time tar was constantly being pumped through the scrubbers. This led to an investigation; and, on sounding the well, we found it nearly two-thirds full of a thick, pasty deposit. How it became so full at first puzzled me, until I happened to notice that the water, which was being pumped from a siphon in connection with the purifiers, and allowed to run into a seal cup full of ammoniacal liquor, caused a white precipitate to be thrown down, which, of course, accounted for the difficulty. The well being 20 feet long, 12 feet wide, and 12 feet deep, with only a 2 feet 6 inches square manhole in the center, the problem of how to get this deposit out without stopping work in any way became a difficult one. We managed to improvise a dredger by erecting a pair of poles over the manhole, and providing a crab and chain connected to a strong scoop furnished with a projecting point in which a couple of holes were drilled. The *modus operandi* was then as follows: A man stationed at the winch lowered away, while another, standing over the manhole, furnished with a long pole, which he inserted in the holes already mentioned, pressed the scoop back to the end of the well, and also down into the thick material at the bottom. The man at the winch then reversed his action and hoisted it up. After about a week's labor we got everything clear; and our apparatus, if primitive, had the merit of being successful.

Spent Lime.—Passing on to the purifiers, in which lime solely is used, they are worked in rotation; and having had a convenient outlet for spent lime in the shape of the sea and beach, the cost of this method of purification has not proved excessive. Our account under the heading of purification and sundries was working out to about 14.58 cents per ton of coal carbonized; and at the same time we have kept down the sulphur to an average of about 10 grains per 100 cubic feet, as reported by the official tester to the Company. Some seven years ago, owing to the numerous complaints we had from people in Torquay and Cockington of the smell arising from the spent lime during certain winds, we were forced to take steps to minimize the nuisance, and for some time always emptied the boxes at night. This answered fairly well during the winter; but in the summer, owing to the inhabitants sleeping with the windows open, we were again requested to take immediate steps for the prevention and cure of this noxious smell. At that time we were prevented from using oxide owing to the want of revivifying space; so we had recourse to drawing air through the spent box for three days and nights, and passing these fumes into a small oxide purifier. We have kept to this process ever since, having found it work fairly well; though on one occasion, owing to one of the gas valves leaking and the oxide firing, we had a small explosion in the purifier house. Now we have to face another complaint—this time from the newly appointed Devon Sea Fisheries Commission—who object to the deposition of spent lime on the shore, on account of the harm it is said to do the immature fish. But I am glad to say that at last the farmers are coming to our rescue, and are beginning to realize what a valuable manure is, so to speak, at their gates, for there is a considerable demand springing up for it; and I am entertaining hopes that in the near future we shall be able to sell, instead of giving it away. I have not, for many reasons, yet tried what the admission of a percentage of air would do to minimize the cost of purification. Judging from the numerous reports of its success in the *Journal of Gas Lighting* and other papers, it seems under certain conditions to give great satisfaction; and I hope to try the process at an early date.

Constructing a Tank.—Our storage accommodation in 1894 being about 25 per cent. under our largest output, my directors consented to build a new holder and tank, and I was accordingly instructed to get out the plans and specifications and to fix on the site. I determined to build as large a holder as I could between one of our existing ones and the governor house, and so made the drawings for a tank, 114 feet in diameter and 27 feet deep, to contain a 3-lift holder, of which two lifts were to be erected at once. The contracts were let, and the excavation was commenced in May. I had had one trial pit sunk adjacent to the site, in order that the contractor might judge the sort of soil and rock he would have to contend with. This indicated that the excavation would he fairly easy, being through a soft, red sandstone, with occasional thin seams of stiff clay, and of a slightly harder texture as we reached the full depth. It was found, however, on commencing the excavation, that this guide was a most deceptive one; and for nearly the whole circumference of the pit the excavation was in a sort of bastard slate foundation, or, as we call it in Devonshire, "shillit." For the most part, it was almost more easily excavated than the sandstone; and only as we reached the bottom was any recourse had to blasting. One of the hardest pieces was adjacent to the existing holder, from which it was only 10 feet distant, and this caused us a good deal of anxiety, as in spite of extra timbering the embankment surrounding it showed signs of settlement, and the water which drained in on that side was distinctly "gassy." Another hard place was almost immediately opposite this, and was where the inlet and outlet pipes had to come in. The rock here was of an entirely different nature, consisting of a very hard sandstone, which gunpowder would not touch; we therefore had to use dynamite. The excavation was made in the usual way, by digging a trench round the whole circumference, 12 feet wide, and closely timbered and strutted throughout. Water did not trouble us very much, as in spite of unfavorable weather a couple of 2-inch siphons leading to the beach were sufficient to keep us clear until we came to the bottom, when a small pulsometer was set up.

The excavation being finished, we put a ring of 4-inch drain pipes round the whole circumference, to lead the water to the sump, and proceeded to put in the concrete foundations and chambers for the inlet and outlet pipes. We then brought up the walls, which were of brick and cement, backed with clay puddle, to the height required. The center portion was next taken out, and the cone formed, concreted over, and finished with neat cement. On January 1st, 1895, the contractor for the ironwork took possession, and commenced the erection of the holder, which was finished by May 30. Water was then run into the tank, which proved to be a sound one, though not absolutely tight. The inlet and outlet pipes (which were of steel, 27 inches in diameter, with cast iron siphons and duckfoot bends) were finished off, and the holder inflated with air for testing and adjusting the carriages. We then sealed the pipes with water, and tested the holder for soundness; and this having proved satisfactory, we proceeded to connect the pipes to the inlet and outlet mains.

Repairing the Inlet Pipe.—I was congratulating myself that at last my anxieties were over, when word was brought that the men could not pump the water out of the inlet pipe. I had the cover removed, and found it half full of water. We, therefore, attached a steam pump, which pumped the water out after about one hour's work; and I was then lowered down the pipe on the gasholder side, to see what was the cause. I found that the duckfoot bend had cracked right across the bottom, and that the water was rushing in almost as fast as we could pump it away. This was a very serious matter; and at first the only thing to be done appeared to be to empty the tank and take out the bend, which meant at least six or seven weeks' hard labor, besides running the risk of damaging the tank. As I wanted to let another holder down for repairs, I determined to try and stop the leak in a different way. I first of all satisfied myself that the incoming water was not from the tank, but from the land springs, on account of the water only rising in the inlet pipes to a certain height, which was about 10 feet below the level of the water in the tank. I then coupled up the steam pump to the sump hole, which fortunately had been left open, and proceeded to pump the water out of that. This reduced the inflow to a very small stream, and a man was able to go down and drill an inch hole in the bend just above the crack. Into this was driven a piece of tapered iron pipe, and then a length screwed on sufficiently long to reach the top. The water in the sump was then allowed to regain its natural level, and we poured down the 1 inch pipe Portland cement grouting, feeding it in with a small iron rod. After letting it stand for about 12 hours, we again pumped out the water from the pipe, and

found, to our relief and satisfaction, that everything was tight. To make assurance doubly sure, a ¾-inch wrought iron plate was fashioned to the bend, bedded in with red and white lead, and screwed on with set screws, and we have experienced no trouble with it since. As to the cause of this unfortunate accident the contractor and myself were at variance—as was probably only to be expected. He held that it was brought about by a settlement of the wall of the tank; but as soundings and levels taken on the curb showed no signs of settlement, and as the rest stones were perfectly true one with the other, I could not accept this reason. My own opinion is that it was caused by a strain being set up in the bend itself, owing to the shrinkage of the metal in casting.

Distribution and Slot Meters.—Turning to the distribution, we have two trunk mains leading into the town of Torquay, from which various branches are taken off *en route*. Torquay is, as many of you know, a very up and-down sort of a town, and may be said to be built on five hills. The levels range from 13 feet to 448 feet above Ordnance datum; and as the works stand at about 50 feet above the datum line, we have a good range of varying altitudes to supply. The greater part of the town is laid out with villa residences, with usually a large garden attached to them; and though we have about 46 miles of mains, the number of consumers per mile of main is very low—being, according to our last returns, 58. This number will in the present year be increased, owing to the growth of the prepayment system. No effort has hitherto been made to reduce the pressure on the hills—which at some parts of the day is excessive—beyond the laying of small sized main pipes, and for many reasons the question of districting is one that will have to be approached with considerable caution. Nearly all the houses have been fitted with very small pipes—½-inch for the most part—and the moment the pressure falls below 25-tenths, the office is filled with complaints of no gas, bad light, etc. A typical case has just been brought to my notice. The pressure at the back of the house was 16-tenths, and in the front only 4-tenths; and the moment you explain this to the consumer, the answer comes: "Oh, if I have to pull my house to pieces, I may just as well have in the electric light." Still, something will have to be done to reduce the unaccounted-for gas, which at present stands at the high figure of 10 per cent., though that this is all leakage is not, I think, the case. Condensation plays an important part, also the difference in temperature, and last, but not least, the public lighting, which is carried out by the Corporation on the average meter system. However, this year I look forward to trying in a small way the effects of regulating the pressure by means of district governors, and hope at some future date to lay the results of the experiments before you.

The consumption per consumer, disregarding the amount used for public lighting, is fairly high, working out to about 43,000 cubic feet, whereas in 1879 the amount was only 33,000 cubic feet. This, of course, shows that our efforts to increase the consumption by reducing the price of gas, and by the letting out of cooking and heating stoves, have met with a fair share of success; but though one must not grumble at an increase, however obtained, I would far rather have found that the amount per consumer was stationary, and the rise accounted for by a larger number of consumers.

We have now introduced the prepayment system, which promises to rectify this. We have just completed one year's working, during which time we have fixed over 400 meters, giving the consumers gas at the rate of 20 cubic feet for 2 cents, and supplying one pendent, one bracket, and a boiling ring, and, of course, doing all the fitting. This latter is let to a local gasfitter, at the rate of $4.12 per house, he finding all materials, from the stopcock, excepting the fittings above mentioned. We find that the average cost of fitting up the houses works out to $26.75; and as the excess price is 29 cents per 1,000 cubic feet, I hope to show my directors that this new field for extension is one worth cultivating. The average consumption per house works out at about 9,000 cubic feet; but this is probably a low estimate, on account of the larger number of meters having been fixed towards the end of the year. We have had few difficulties in our way. The most general has been the inclination of the meter to let people have too much gas for their money; and though they had signed an agreement to pay for any excess of gas used, it was astonishing to find the number of consumers who said they had never read or understood that condition. This has been rectified now, and the last report is more satisfactory; only three or four having been discovered slow, and these only to a slight degree. We found it much better to pass over these relapses in silence, as, the system being on trial in our neighborhood, it would not have done us any good to allow the consumers, who, generally speaking, are not slow to let the world know of their fancied wrongs, air their grievance.

Electric Lighting.—Torquay has, like many other towns, been bitten with the craze for electric lighting, and I hoped to have been able to give the meeting some of the results of the enterprise. The Order was obtained some six years ago, but from one cause and another no start was made until the beginning of last year. Everything was to have been ready by about the end of September. Owing, however, to the disastrous strike of the engineers, the works are not yet in order, so that I can only give you a few particulars of the machinery employed, and not as to how far it has affected the consumption of gas. The machinery is placed in some stores belonging to the Corporation adjoining the new harbor. It consists of three Babcock and Willcox boilers, each 150-horse power, and one Green's economiser. There are three sets of Willan and Robinson's 3-crank compound engines, each working up to about 250 indicated horse power, driving the alternators made by Easton and Anderson; three rectifiers for the current supplied to the arc lamps, made by Ferranti, by whom also the switchboard is manufactured; and the usual feed and circulating pumps for the condenser, for which sea water is to be used. About 3½ miles of cable have been laid in the main roads and streets; and the Corporation have erected 57 arc lamps to light the streets. How many gas lamps are going to be displaced is not yet settled, but there is one instructive fact in connection with these. The price fixed by the Electric Light Committee to be charged for the arc lamps is $125 per annum each, or a total of $7,125. The present amount the Corporation pay us for the gas supplied to 820 lamps is $7,435 per annum; so that in future we may expect the lighting bill for Torquay to be a fairly heavy one. As an example of what can be accomplished by gas, we have had a Denayrouze light fixed outside our offices, and we do not think we shall suffer much from comparison.

In common with many other towns we suffer very much at times from naphthaline; and I have tried many remedies, all of which have been recommended me as certain cures of this evil; but, alas, with no diminution in the number of complaints. This past year we certainly have had fewer complaints, but I cannot pretend that this is owing to any new method of working, but rather to the fact that the extremes of the night and day temperatures have been very much less than usual. M. Bremond and Mr. Botley have shown us how to free our services from this pest; but we want to go further than this, and find how to keep this hydrocarbon from being thrown down and carried into the tar well. It is a difficult problem, but at the same time an exceedingly interesting one; and no doubt a rich reward awaits the man who can solve it satisfactorily.

The residual market, with the exception of tar, appears to be in a decidedly more healthy condition at the present time; and the wish of "long may it last" will no doubt be re-echoed by all here. The mountains of coke that blocked our yards, and the heavy stocks of sulphate, have disappeared. The extended use of water gas will, no doubt, tend to prevent coke from becoming a drug in the market; while one hopes that the new Association of Sulphate Producers will help to keep this article at a more regular price, and, by removing the prejudices that exist in the minds of our agriculturists against the use of this valuable fertilizer, extend its use considerably in this country. With regard to tar, matters do not seem quite so hopeful. There is one way by which some of the surplus tar might be used up, and that is by the use of tarred macadam for road making purposes. Our borough engineer, Mr. H. A. Garrett, is now laying some down as an experiment, and so far the results have been very satisfactory.

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An Advising Chemist.—In concluding this address, there is one other subject on which I should like to say a few words. I have been very much struck with our last President's able pleading for the establishment of a gas works for the purpose of experimenting and reasoning out the laws which govern the economical production of coal gas; and I cannot help wishing that such a realization of his views were likely to take place, for it would, I firmly believe, be of inestimable advantage to the profession to have such a works established. However, his plea, as far as I am aware, has been received with silence. I now, with all due deference, venture to make a suggestion; and I do not see any great difficulty to prevent it being carried out. Now, there must be a large number of works the managers of which have neither the time, means nor apparatus to carry out any experiments necessary for the reasoning out of the phenomena which often occur, and especially is this true when it comes to making analyses. The scheme, therefore, that I venture to offer for your consideration is briefly this: That the Institutes (I hope one day we shall again be able to say the Institute) should appoint a chemist whose duty would be to test samples of any materials that might be sent him, and, generally,

to collect and classify data of the many difficulties and odd circumstances that are continually cropping up in any works. He should also be allowed to travel to any works requiring his assistance and advice. Now, of course, I do not mean that this should be done free of expense to the gas company or authority. A fee according to the distance and time required should be charged to recoup the Institutes for the outlay, and the information obtained should only be open to members. By this means, I think, our leading bodies would be capable of doing a large amount of useful work, and of spreading much important information among the profession. Take, for example, the work just accomplished by a sub-committee of the Incorporated Institution of Gas Engineers in their report on a proposed 10-candle standard. Who will deny the importance of this report, and who does not thank the members for having given so much valuable time and thought to carrying out the necessary experiments? The work that these gentlemen have done so well should, I say, be carried on by paid assistants, under the direction of the Councils of the Institutes, on the lines briefly sketched above.

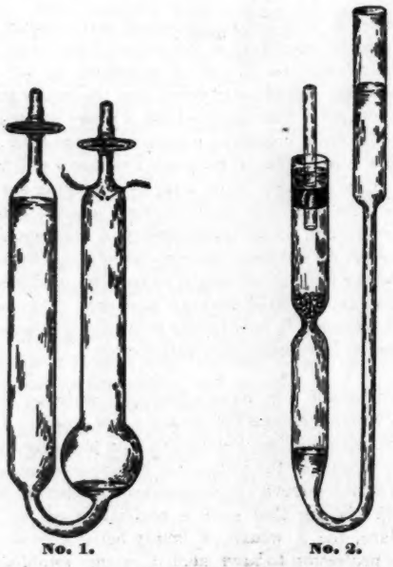
With these words I have finished, and it only remains for me to thank you for the patience with which you have listened to what I am afraid is a purely local address, but which, at the same time, is the best I have to offer you.

The Determination of Methane, Carbon Monoxide and Hydrogen by Explosion in Technical Gas Analysis.

[By W. A. Noyes and J.W. Shepherd, in *Jour. Am. Chem. Soc.*]

The determination of carbon monoxide in technical gas analysis with the Orsat apparatus is not very satisfactory, partly because the gas is absorbed so slowly by the cuprous chloride, and partly because the cuprous chloride must be very frequently changed unless two absorption bulbs filled with the reagent are used. These difficulties may be avoided and the carbon monoxide, hydrogen, methane and nitrogen may be determined by explosion, if the determination is accompanied by a determination of the oxygen consumed in the combustion, by explosion, of a known volume of the gas. For this purpose we have introduced in the Orsat apparatus in place of the fourth bulb an explosion pipette of the form shown in Fig. 1.

The pipette has the advantage over that usually supplied with apparatus for gas analysis, that during the explosion the gas is confined by glass stopcocks on both sides, insuring positively against loss during the moment of high pressure in the apparatus. A little sulphuric acid is added both to the water in the explosion pipette and to that in the measuring burette. This greatly decreases the ionization of the carbonic acid, and so lessens the solubility of the carbon dioxide in the water. The results given below demonstrate that the error arising from the solubility of carbon dioxide in dilute acid in the case of mixtures containing 6 to 8 per cent. of the gas must be very small.



No. 1. No. 2.

For the purpose of determining the amount of oxygen remaining after the explosion, we have attached to the outer end of the capillary tube of the Orsat apparatus a small hydrogen generator of the form shown in Fig. 2. The hydrogen is generated from aluminum foil and a solution of potassium hydroxide of sp. gr. 1.27. The lower bulb of the generator should have a capacity of about 20 cc. The stopper bearing the delivery tube of the generator is pushed into its mouth and covered with water to avoid diffusion of the hydrogen, and the rubber connection with the capillary tube of the Orsat is surrounded with a glass tube filled with water for the same reason. With these precautions, hydrogen, which is almost chemically pure, may be taken into the measuring tube of the apparatus whenever desired.

The analysis is carried out as follows: In the case of illuminating gas the carbon dioxide is absorbed in potassium hydroxide of sp. gr. 1.27, the illuminants in fuming sulphuric acid followed by the caustic potash, and the oxygen in an alkaline solution of pyrogallol. The residue is then left over the pyrogallol, the side bottle is raised till all gas is expelled from the capillary tube of the apparatus, and then about 85 cc. of air are taken in and accurately measured. In all measurements 3 minutes were allowed for the water to run down the walls of the burette. The burette was kept at a constant temperature by running water through the jacket surrounding it, as the temperature of the room where we worked was quite variable. To facilitate accurate reading a scale, corresponding to the scale of the burette, was made on the edge of the case of the apparatus. By means of such a scale it is very easy to bring the water in the side bottle to the level of the water in the measuring tube and also to bring the eye to the exact level required. After measuring the air, gas is admitted from the residue over the pyrogallol. The amount to be taken will vary, of course, with its character. It should be taken in such amount as to require 9 to 10 cc. of oxygen for its complete combustion. If too much is taken, there may be danger of burning nitrogen, and also there will not be enough oxygen left for the second explosion with hydrogen. With a gas of unknown composition 6 to 8 cc. may usually be taken at first, and, if the mixture will not explode, hydrogen may be added, 1 cc. at a time, till an explosion can be secured. From the data thus secured the amount of the gas which should be used can be determined. Before attempting an explosion the gas should be passed into an explosion pipette and back to the measuring burette at least twice, and better three times, to secure thorough mixing. After the explosion the contraction is determined and then the carbon dioxide. Then about 20 cc. of hydrogen are added, and after mixture as before, and explosion, the contraction is determined. One-third of this contraction will give the amount of oxygen remaining after the first explosion. If this amount of oxygen be subtracted from the amount in the air originally taken, the difference will be the amount of oxygen used in the first explosion. Air is assumed to contain 20.9 per cent. of oxygen in these calculations.

The calculation of the results is based on the following equations, in which the symbols are used to represent volumes of gas:

1. $CH_4 + CO + H + N$ = Gas taken.
2. $2CH_4 + \frac{1}{2}CO + \frac{3}{2}H$ = Contraction.
3. $2CH_4 + \frac{1}{2}CO + \frac{1}{2}H$ = Oxygen consumed.
4. $CH_4 + CO = CO_2$ formed.

Hence—

H = Contraction less oxygen consumed.

$CO = \frac{2}{3}(2CO_2 + \frac{1}{2}H - O$ consumed).

$CH_4 = CO_2 - CO$.

N = Total gas $- (H + CO + CH_4)$.

The following is an illustration of the record of an analysis:

	Reading.	Volume.
Air	12.96	87.04
Gas	0.58	12.38
Contraction	15.4	14.82
CO_2	23.39	7.99
H	1.24	22.15
Contraction	24.35	23.11
Oxygen originally present	.....	18.19
" of second explosion	.....	7.71
" of first explosion	.....	10.48

Hence—

Hydrogen	= 4.34	= 35.06	per cent.
Carbon monoxide	= 5.12	= 41.38	"
Methane	= 2.87	= 23.19	"
	12.33	99.63	

To determine the accuracy of the method, a mixture of known composition was prepared. Hydrogen was first admitted into the measuring tube of the burette, from the generator described, and then methane, generated from sodium acetate and soda lime, was introduced. After thorough mixture, three determinations of the proportion between the methane and hydrogen were made in the usual manner by explo-

sion. The results agreed quite closely with the composition of the gas as determined by measurement, indicating that the methane was practically pure.[1] The results were—

	Calculated.	Found.			Average.
Methane..	38.5	39.9	39.3	39.2	39.5
Hydrogen	61.5	60.0	60.0	60.7	60.2
	100.0	99.9	99.3	99.7	99.7

	Calculated.	Found.			Average.
Methane..	37.6	38.2	38.0	38.5	38.2
Hydrogen	62.4	60.9	61.3	60.2	60.8
	100.0	99.1	99.3	98.7	99.0

There seems to be some tendency to high results for methane, but the close approximation to 100 for the total indicates that there was probably some loss of hydrogen by diffusion or absorption. If the gases are thoroughly mixed before explosion, there would seem to be no occasion for such gross errors in the determination of hydrogen as were observed by Gill and Hunt. Gases mix by diffusion very much less quickly than is commonly supposed.

The remainder of the mixture of methane and hydrogen was then carefully measured and a mixture of carbon monoxide and carbon dioxide obtained by heating oxalic acid with concentrated sulphuric acid was added. After removal of the carbon dioxide, the gas was again measured, and, on the basis of the result, combined with the results of the analysis of methane and hydrogen, the composition of the total gas was calculated. A series of analyses of the mixture was then made.

First Series.

	Calculated.	Found					Average.
Methane.....	23.08	23.6	23.0	22.8	23.3	23.3	23.21
Carbon monoxide....	41.52	39.6	40.6	40.9	41.2	40.5	40.55
Hydrogen.....	35.23	35.0	35.6	35.4	35.0	34 5	35.09
	99.83	98.2	99.2	99.1	99.5	98.3	98.85

Second Series.

	Calculated.	Found						Average.
Methane.....	22.37	22.7	23.1	22.6	22.7	22.7	22.4	22.68
Carbon monoxide	41.48	40.4	40.0	40.5	40.2	39.8	40.0	40.15
Hydrogen.....	35.80	35.3	35 4	35.6	35.9	35.7	35.9	35.64
	99 65	98.4	98.5	98.7	98.8	98.2	98.3	98.47

The objection that the error is multiplied because of the small amount of gas which must be taken for the explosion, applies to this method as it does to the usual explosion method for methane and hydrogen, of course. It is to be noticed, however, that the determination of methane, the most valuable constituent as a fuel, depends on the combined measurements of the carbon dioxide, the contraction and the oxygen consumed, instead of depending on the carbon dioxide alone, as is the case with the older method. By the method in common use any carbon monoxide which has failed of absorption is counted as methane after the explosion. Another advantage is that the errors are of a compensating nature, so that when methane is found too high, carbon monoxide and hydrogen will usually be found low, and in such ratio that the total fuel value will be nearly constant.

We have used with the Orsat apparatus a stopcock lubricant described by Professor Ramsay at the Toronto meeting of the British Association, though he said it was not original with him. Equal parts of black rubber, vaseline and paraffine are heated to gentle boiling for a quarter of an hour in a beaker. The lubricant is sufficiently viscous to hold against an atmosphere of pressure, if necessary, gives no hydrocarbon vapor to a vacuum, and the stopcocks in which it is used do not become set even after long standing. The last property makes it especially valuable for the Orsat apparatus.

Cleaning the Globes of Inclosed Arc Lamps.

Mr. J. H. Halberg says that the trimming and cleaning of the inner globes on inclosed arc lamps is of the utmost importance, as the efficiency and candle power depend, to a large extent, on the transparency of the inner globes.

It will be found that most of them are covered inside with a gray-white dust or film, which comes off if the globe is washed in clean water; but some, even after they are washed in water, show a brown-black stain around the top of the globe which apparently will not come off, no matter how much it is washed; in fact, it appears as though it were a natural color in the glass itself.

This is due to several causes: the most common is the impurity of the carbons, which contain too much metallic material; another is too great a length of the lower carbon, which brings the arc too near the neck of the inner globe; or the cause may be too much current flowing across the arc, especially during the few minutes after trimming the lamp with new carbons, this causing an excessive flame that gets in contact with the globe and in that way stains it.

There is to my knowledge only one way to clean a globe in this condition, and that is by dipping the burned part in hydrofluoric acid. This acid is very dangerous to handle, and much care should be exercised when it is used. As this acid will eat through most every material except lead and wax, it must be kept in a jar of either of those materials. I prefer lead, as the acid gets warm when it acts on the glass, and I have seen cases where the wax melted and let the acid run out.

For this use a round lead vessel about 6 inches high by 3½ inches in inside diameter may be made from an ordinary lead pipe of that size by cutting it off, setting it in clay or something similar, and pouring in melted lead so as to form a base about ¼-inch thick. It should be burned to the pipe with a tight joint. Solder cannot be used, as the acid eats the solder. Enough hydrofluoric acid should be put in this lead vessel to cover all but ½ inch of the inner globe when it is inserted. The acid is sold in special, prepared wax bottles and care must be taken in handling them, especially in warm places. If any acid gets on the hands, it is well to wash them in water at once and apply pulverized soda or something similar.

For this cleaning a place should be chosen where there is draught to carry off the fumes and if possible where there is running water. If the latter cannot be obtained, two large tubs of clean water may be substituted. Boxes, with perforated bottom, spaced off for about 25 globes each, should also be provided. With rubber gloves dip the part of of globe that is burned in the acid (this immersion will only require about one or two seconds in ordinary cases), then give it a liberal bath in the first tub of water; wipe off with a rag the light white film on the globe, and then dip in the second tub of water. After this, place it in the box with the perforated bottom. After this box is full, remove it to some warm place, as the top of a radiator, steam pipe or boiler, and after an hour the globles will be as good as new, although some may need a little cleaning with a rag.

Some people advise, in place of using the acid as described above, the use of 10 parts of water to 1 part of acid; this method requires at least 10 minutes immersion, and if several globes are in the bath at once, the chance of breakage is increased 50 per cent.

The above suggestions may be old to many readers, but as I was requested to write something on this subject, I presume some one may be benefited by this article.

Strength of Concrete with Different Aggregates.

In his annual report for the last fiscal year Captain Wm. M. Black, Corps of Engineers, U. S. A., Engineer Commissioner of the District of Columbia, gives some important experiments on the influence of differences in the aggregate used with the same mortar to form concrete. The experiments were made with the assistance of A. W. Dow, inspector of asphalts and cements, and I. H. Woolson, in charge of the mechanical laboratory at Columbia University. In making the experiments the Round Top natural and Atlas Portland cements were used. Enough of the ingredients were mixed each time to give 2 cubic feet, and the concrete was made in 1-foot cubes without special care to secure exceptions. The manner of mixing was as follows:

The damp sand was first thoroughly mixed with the dry cement, after which sufficient water was added to make a plastic mortar. This mortar was mixed with the aggregate, which had been previously sprinkled, by turning over with a shovel until every stone was thoroughly coated with mortar. The concrete was then shoveled into the molds, care being taken that the coarse and fine stone should remain evenly distributed. The molds were filled to a depth of 4 inches and lightly rammed, this operation being continued until they were filled. The ramming was done in moderation, just sufficient to settle the concrete and bring mortar to the surface.

The cubes were wet twice a day until they were tested. The natural cement used in these cubes had 14 per cent. retained on a 100-mesh

1. This accords with the statement of Freyer and Meyer, *Zeit. Phys. Chem.*, 11, 28, but not with that of Gill and Hunt in this Journal, 17, 988.

sieve, began to set in 20 minutes, and was hard in 36 minutes. At the end of one day its tensile strength was 96 pounds per square inch, and at the end of 7 days it was 180 pounds. The Portland cement had 8.5 per cent. residue on a 100-mesh sieve, and its initial set occurred at the end of 3 hours and 10 minutes, the hard set being 1 hour and 55 minutes later. Its net tensile strength was 441 pounds after one day and 839 pounds after seven days. The tensile strength of these cements in various mortars was as follows:

Class of Cement.	Natural Cement. Standard Grade of Sand.	Natural Cement. Ordinary Grade of Sand.	Portland Cement. Standard Grade of Sand.	Portland Cement. Ordinary Grade of Sand.
Ratio, sand to cement.....	2	2	3	3
Age:				
7 days.....	91	46	248	256
1 month.....	188	103	429	401
3 months.....	327	247	398	465
6 months.....	414	...	428	486
1 year.....	485	340	474	493

The sand used in the concrete weighed about 90 pounds per cubic foot when damp. The sieve analysis gave residues in percentages on screens of different meshes per lineal inch as follows:

Mesh.....	3	6	8	10	20	40	60	80	100
Residue.....	0	7.5	7.5	13	30	32	7	2	0.5

The broken stone used in the aggregate was a gneiss, and the gravel was a clean quartz material dredged from the river. The mortar used in the tests was mixed in the proportion of one part cement to two parts of sand by volume, and the variation in the concrete was produced by changing the parts of gravel and broken stone. All concretes are considered to be made of eight parts, the mortar forming three in every case. The 10-day cubes were crushed on an Emory testing machine at Columbia University, and the remainder on a 600,000-pound hydraulic press at the works of Watson & Stillman, New York City. The press, being roughly calibrated, was found to give results 3.7 per cent. too high, and a subsequent more careful examination shows that 8 per cent. is a fair maximum. As comparative, not exact results, were desired, the figures in the following table have not been corrected. The figures for 1 year cubes are averages of five tests, and all others give the mean of two tests. The table is as follows:

Strength of Concrete with Different Aggregates. The Natural Cement Mortar was mixed 1:2, and the Portland Cement Mortar 1:3.

Cement.	Parts in Eight Parts Concrete: Gravel.	Parts in Eight Parts Concrete: Stone.	Ratio of Void in Aggregate to Mortar (Void = 1.)	Crushing Strength, Pounds per Cubic Foot: 10 Days.	45 Days.	3 Months.	6 Months.	1 Year.
Natural.....	..	6	0.839	32,900	77,687	54,022	114,412	131,700
"	3	3	1.070	15,500	52,362	85,315	90,965	121,100
"	2	4	1.006	....	....	....	....	131,700
"	..	6	0.962	....	....	....	....	115,200
"	6	..	1.291	12,500	60,652	51,980	49,437	109,900
"	..	6	0.839	....	....	85,880	....	119,300
Portland.....	..	6	0.839	130,750	{343,520 / 172,325}*	324,875	361,600	440,040
"	3	3	1.070	136,750	266,962	....	298,037	396,200
"	2	4	1.006	....	....	....	....	408,300
"	..	6	0.962	....	....	....	....	388,700
"	6	..	1.291	99,900	234,475	385,612	265,550	406,700
"	..	6	0.839	....	....	234,475	220,350	266,300

*Owing to the great variation in these results both are here given.

A. W. Dow, in a special report on the tests, summarizes the results in the following: "In examining the results of these tests it is evident, especially with the natural cement, that gravel makes a much weaker concrete at the start than stone. This was also strongly manifested in the handling of the cubes for the 10-day test; the greatest care was necessary to prevent the edges and corners being broken off those cubes containing gravel, while the all-stone cubes were much more durable. Disregarding the three and six months tests, which appear unreliable, it is very evident that the strength of the gravel is gaining on the stone concrete, and will in time I believe, pass it. From these tests, if we disregard the cost and are working for strength only, it would seem that the kind of aggregate to use should depend entirely on the class of work. If the work is of such a character that the concrete will be subjected to as much strain during its first month as it will ever receive, the aggregate should be of stone alone, when natural cement is used, and stone or a mixture of stone and gravel when Portland cement is employed. Gravel alone should be used as an aggregate with natural cement in concrete only when its maximum strain will be received after a year. In the case of Portland cement, however, gravel alone may be used in concrete receiving its maximum strain after three months."

Coal Cutting Machinery.

Mr. Cyrus Robinson, writing in "Mines and Minerals" on the topic of how the present efficiency of coal cutting machines may be increased by a combination of electricity and compressed air, says:

Although great improvements have been made during the past decade in the design and manufacture of coal cutting machinery and the plants for furnishing power for the same, there is still much room for further developments and economies, and it is the purpose of the writer to briefly review the present available systems and to show where their efficiency can be materially improved.

We now have practically only two systems of power for mine work—electricity and compressed air. The former as compared with the latter in its present form, has decidedly the advantage, both in points of efficiency and maintenance, and if a more universal system of coal cutting machines were available, very little would be left to be desired as compared with the present. It is well known that the present forms of electrically operated cutters are only successful when the conditions of mining and the material are suitable; that is, where the roof is good, and of sufficient height, and the coal is fairly free from impurities. The height of the roof should be at least 36 inches to allow the present form of machines to be worked to advantage. Where these conditions exist breast coal cutters are very successful, and taken as a whole they effect a very appreciable reduction in the cost of mining coal, in rooms and entries.

There should be, however, another style of machine to work with the breast machine; that is, one to be used in robbing, turning room necks in narrow entries and in working out faulty coal or coal where the roof is bad. For this class of work the present form of compressed air punching machine has proved most successful, but the machine with the present appliances is not available for mines equipped with electric power plants.

A number of different pick machines, using an electric motor, have been designed and built during the past ten years, but so far as the writer knows none of them has been able to compete with the compressed air pick machine, both of them using the same principle of cutting the coal. The reasons for this, I believe, are the peculiar requirements from an electric motor, whose motion is rotary, to enable a blow to be struck with the pick approximating that obtained by hand or compressed air. A careful study of the problem, together with experience obtained from the machines that have been built, seems to indicate that it is a practical mechanical impossibility to convert the steady rotary motion of an electric motor into a reciprocating motion having a speed of zero at the commencement of the stroke and accelerating to a speed of about 600 feet per minute at the end of the stroke, when the blow is struck. The number of blows struck per minute is one of the strongest factors against using a rotary motor for this kind of work. On the majority of electric pick machines designed, springs have been employed; the operation being to compress the spring by means of a cam, at the same time drawing the pick back with it, and suddenly releasing both spring and pick. This operation causes the pick to be forced forward and a blow struck the coal, the force of the blow being equal to the momentum of the pick and holder. This operation repeated from 250 to 300 times per minute very soon crystallizes the spring, causing it to break. In addition, the severe jar on the gears and other parts of the machine is very great, resulting in a high maintenance expense.

As an example of the inadequacy of the present systems to meet even approximately all conditions, I wish to cite the equipment recently installed by the Berwind-White Coal Mining Company, at their new

operation at Scalp Level, Cambria county, Pa., I understand that it is the intention of this Company to mine some 5,000 tons of coal per day at this operation, and to do the coal cutting and hauling entirely by machinery. What might be termed two distinct plants have been installed to do this work; compressed air for cutting and electricity for haulage; involving practically a double expense in many of the branches, and a very much larger plant as a whole than if the cutting and hauling were operated from one system.

Had there been a successful electric punching machine on the market at the time these mines were opened it is very probable that electricity would have been adopted throughout, thus effecting a large saving both in first cost and in operation. The conditions at the mines of the Berwind-White Company were such that in many places the breast machines would have proved very successful, while in others they could not have been used to any advantage, whereas the pick machine operated by compressed air can be used to advantage in any part of the mine.

The writer has had in mind for some time the development of a system, as an adjunct to the present electric machines and plants, which would, it is believed, fill a want now felt by every user of electrically operated breast machines. The system comprises a separately operated portable compressor driven by an electric motor, and the present form of compressed air pick machines. It is well known that in standard compressor plants the efficiency is low, a very large percentage of the loss being due to the necessity of cooling the air before it is discharged to the receiver, this in turn followed by the troubles from the freezing as the air and temperature are expanded in use. With the arrangement proposed the air would be used at practically the same temperature obtained by compressing without cooling, and in use would be expanded down to a temperature slightly below that of the surrounding air; in this way an increase in efficiency would be obtained of at least 30 per cent. This in turn means that a compressor of about 30 per cent. less capacity would be required where the air is used without cooling.

The designs for an equipment of this kind show that everything required for the operation of two standard pick machines can be mounted on a truck which could be easily pushed around by the machine runner and his helper, together with the machine itself, and would therefore not be any more cumbersome to handle than the standard breast machine.

The advantages claimed for this arrangement when used in connection with electric plants are: No hand mined coal; maximum efficiency from the breast machines, as they can be used entirely where the conditions are most favorable and the pick machines used for room turning, robbing and faulty work; larger yield of coal per acre; less timber for propping, as the work could be kept up much closer and sections of the mines worked out rapidly.

The above described arrangement may seem, and correctly so, much in the nature of an expedient, but it is a profitable one as compared with anything else available, and therefore a good one to adopt.

Danger from the Use of Electricity in Coal Mines.

Engineering News says that in the Consolidation Colliery, near Gelsenkirchen, Westphalia, a series of interesting tests have been made of the dangers attending the use of the electrical apparatus actually employed in coal mines. These tests, says London *Engineering*, have been broader and more complete than any other investigations of the kind in Belgium, France or Germany.

The tests were made in September, October and November, of 1897, by Heise, on behalf of the Westphalian miners, and by Thiem, on behalf of Siemens & Halske, of Berlin, who furnished the apparatus. The special testing gallery was 110 feet long, 6 feet high and 4½ feet wide; it was open at one end and closed at the other, and lined with three layers of pitch pine held by I-irons. Along the top ran a line of safety holes, covered with stout paper, and in one side were 15 windows of strong glass. At the end of the passage was the explosive chamber, of 350 cubic feet capacity, and fitted with three safety holes and four windows. The methane gas came from an abandoned working fitted with a ventilating pipe to relieve the pressure; and a branch of this pipe introduced into the chamber gas containing an average of 38 per cent. of methane. A gas meter was inserted in the pipe and the flow was regulated so as to obtain, as a rule, a 6 per cent. mixture, though a percentage as high as 9.5 was tried. The latter mixture was highly explosive; the former slightly so.

The incandescent lamp tests were the most complete. Lamps, with their bulbs, were fixed on iron rods and broken. In the 200 experiments bulb and filaments broke simultaneously, and there was bad sparking, and sometimes explosion and sometimes not. In other cases the filaments remained whole, and again explosion did or did not follow. Currents of less than 0.6 ampere, continuous or alternating, did not produce ignition, though there was often sparking; stronger currents generally caused explosion.

The conclusions as to lamps were: Use stout globes around the bulbs to prevent cracking by water dripping on the hot bulb; and for further protection use cages. Take low-current lamps (0.6 ampere maximum) and high voltage, but not above 150 volts; all excessive voltages are dangerous. Have short leading-in wires far apart, lest they bend together and cause short circuits. For the same reason avoid lamps with two filaments in series. This summing up is against the common portable lamp, which has the further disadvantage of not indicating the presence of firedamp. Aside from this, incandescent electric lights are recommended as being probably the safest means of lighting a mine. Arc lamps do not appear to ignite coal dust, even in an atmosphere of 4 per cent. methane; but in 6 per cent. explosions took place whether the lamp was already burning or was switched in. A dust storm did not make the arc flare up. Both continuous and alternating arc lamps are condemned for fiery mines, though they have been safely used in rubber works in air saturated with benzine vapors. While slow switching is generally more dangerous on account of arcs forming, a rapid motion of the switch is also to be avoided. Spark extinguishers, which form a momentary arc, are condemned. Hot wire resistance seems in itself harmless, but danger threatens from contacts. Explosion followed where in a set of resistances placed horizontally, one hot spiral touched another. Melting wires, and especially copper, may ignite the gas; but an iron wire, buried in coal dust and heated by the current until it arced strongly, would not ignite the dust, either in the pile or in a cloud.

Of electric motors, larger sizes were safer than small ones, because they are less affected by variations in load. Carbon brushes spark so little that they are least liable to do harm. A motor under a fine gauze cover set fire to the explosive mixture in the box when started, but the flame did not strike through the gauze. Experiments with 5-horse power tri-phase motors were quite satisfactory; a brush was lifted 30 times from one of the contact rings without any harmful results. To avoid danger, from very abrupt changes in load, the motors should be incased and double brushes used.

The general summary of the tests, as published in the *Elektrotechnische Zeitschrift* for January, 1898, is not unfavorable to electrical apparatus. But ordinary precautions must be applied and extra care will be profitable. Continuous current electric motors and switches, fuses, etc., should be avoided in dangerous parts, and they should be incased wherever used.

The Blast Furnace Gas Engine, at Seraing.

Prof. Hubert, in a recent report to *Stahl und Eisen*, respecting the results obtained from the trial engine for blast furnace gas, operated in the works of the John Cockerill Company, Seraing, Belgium, says that the value of blast furnace gas is dependent upon its contents of carbonic oxide, the amount of which corresponds to that of the imperfectly oxidized carbon in the coke. This fuel has heretofore been used for nothing else but for the heating of the blast and the production of the steam necessary for the operation of a blast furnace plant.

The charge required for the production of 1 ton of pig iron consists, at Seraing, of 4,800 pounds of ore and flux and 1 ton of coke. Hubert assumes that the ton of coke contains 1,700 pounds of carbon, of which 75 pounds enter the iron, while 1,625 pounds remain for combustion. He then dwells on the loss based on the imperfect oxidation of the carbon to carbonic oxide, instead of carbonic acid. The loss by imperfect combustion is larger in England than in Belgium, where fuel is more costly, and a more perfect combustion is aimed at. This would lead to the conclusion that the more imperfect the combustion the higher the heating value of the gas. Tests showed the blast furnace gas at Seraing to contain an average of 997 calories per cubic meter (35.3 cubic feet). Of the total quantity of gas produced by a furnace, 50 per cent. would, according to Hubert, be practically available for the operation of gas engines, and the gas originating from the production of 1 ton of pig iron would develop 2,128,000 calories, sufficient for about 2,500-horse power, or, if the gas be first used for the production of steam, for about 1,800 to 2,000 horse power. The Cockerill Company operating six furnaces, with 650 tons daily production, would gain 1,200 horse power by

the direct use of blast furnace gas, a power equal to the total employed at the works.

But like other authorities, Hubert expresses some apprehension regarding the heat value of furnace gas, and the changes in its composition. Only practice, he says, can teach whether this apprehension is well founded or not.

The gas engine employed at Seraing was invented by Delamare, Debouteville and Malandin, and built at the engine works of Matter & Company, Rouen, France. It is a 4-phase engine. With such an engine one unit of work includes four strokes of the piston, and two revolutions of the shaft, two piston strokes being for pump service and two for motor service proper. During the first stroke of the piston the explosive gas mixture is drawn in, by the second it is compressed, at the beginning of the third it is ignited, and by the fourth the products of combustion are thrown out. At the end of the second stroke a small valve in the cylinder opens and admits the electric spark. The cylinder has a clear width of 9 inches, stroke 17 inches.

The gas required for operating this small engine goes from the furnace first to the boilers, whence it is conducted to a scrubber, filled with coke, which is moistened with water by three injectors. The gas then passes through a second scrubber into the gasholder, installed near the engine. When the latter was put in operation a pressure of 6 atmospheres was employed for the gas mixture, but to render ignition more perfect, the pressure was later increased to 9.5 atmospheres, a storage battery being used for ignition. By these improvements fluctuations in the pressure of the furnace gas and in the temperature of the cooling water were overcome without much difficulty. For washing the gas there are required about 50 cubic feet of water per horse power hour.

In summing up Prof. Hubert arrives at the following conclusions:

A blast furnace produces per 1 ton of pig iron, 4,300 cubic meters, or about 151,790 cubic feet of dry gas, possessing a temperature of 15° centigrade. Hence, a blast furnace of 100 tons capacity per day would produce about 600,000 cubic feet per hour. Assuming that half of this quantity be required for the blast stoves, 300,000 cubic feet per hour would be available for use in gas engines. If the gas has a heating value of 1,000 calories, and the gas engine converts 20 per cent. of it to power, the gas from a 100-ton furnace would be able to develop 3,000 horse power, or from 3 to 10 times as much as with boiler and steam engine.

The gas engine at Seraing has been operated for a year very successfully, notwithstanding the changes in the composition and pressure of the furnace gas. The consumption per horse power hour averaged 177 cubic feet, the engine not always running under full load. When run continuously under a full load it will be possible to reduce consumption to 142 cubic feet. Even at a consumption of 177 cubic feet, there were available 1,800 horse power, and if 400 were required for the operation of the furnace, 1,400 were left for other purposes.

The possibility of installing large engines to be operated by blast furnace gas is beyond all doubt. The Simplex motor at Pantin, a single cylinder engine, renders 250 actual horse power. By connecting two such cylinders, 500 horse power could be obtained, which would suffice to operate a large blowing engine. The utilization of furnace gas in gas engines would do away with boilers. Besides, a large quantity of the gas would become available for other purposes, and, as the gas after having passed scrubbers and coolers possesses almost the same pressure and temperature as the atmospheric air, it could be conducted any distance without loss of power, and used at various localities for heating and power purposes.

The quantity of water required for washing the gas and cooling the cylinder was of little importance. A good steam engine, with condensing apparatus, required at least 50 gallons of water for 1-horse power hour, and a furnace gas engine would require but little more than that.

Hubert finally points to the fact that the gas supply would be shut off during long stoppages for repairing the furnace, hence it would be necessary to provide gas producers, just as other fuel is now being used for furnace boilers during those periods.

IV.—Anxious Moments in a Gas Manager's Day.

By an "Old One," in the *Gas World*.

Tar Well Explosions.—I have known three accidents due to the explosion of gases which had accumulated in the tar and liquor wells. The exciting cause in two cases was a barrow of coke, fresh from the retorts, which was dropped on the ground nearly above; and in the third it was supposed that a red-hot flue, and a crack in conjunction therewith, secured the undesirable result. Each case was attended with unfortunate consequences, both as regards injury to men and damage to property. The question of whether the explosive gas consisted of light hydrocarbons which had been dissolved out of the gas by the tar, and subsequently liberated because they boil at very low temperatures, or of permanent gas that was mechanically carried in with the liquids, say, for instance, by the overflow from the scrubber, could not be exactly determined, as no special attention had been directed to the state of things in the wells before the accident. There is always the suspicion that gas, by some means or other, found its way along some of the pipes that are supposed or intended to convey liquids only.

It goes without saying that the roof of the tar tank should not, by preference, be selected as the site of the coke quenching ground; and no flue for the passage of hot products of combustion should be carried within hailing distance of this indispensable subterranean receptacle. It is usually evident that a siphon seal pipe of the closed U-pattern is not a desirable arrangement for draining off liquid deposits. If such is used the outlet should not be carried directly into the tar well; and any considerable length of descending pipe on the outlet will increase the risk of danger. The longer the descent the greater the power of the siphoning action, if the pipe should be fully charged with liquid. A descent of 15 feet or so would be strong enough to empty any ordinary hydraulic main in a few minutes. The possibility of suction by a siphon action being set up should always be guarded against, and the best way to do this is to use open seal boxes—*i. e.*, closed with loose covers to keep out dust and dirt. In this case, if siphoning takes place, which may be caused by an unusually rapid rush of liquid, air will be drawn in, and not gas. But when all this is done, it is the safer plan to act on the assumption that inflammable or explosive vapors may, under some circumstances, accumulate, emanating from light oily bodies that float on the surface of the liquid; and this idea is supported by the fact that crystals of naphthaline are usually present on the roof of the tar well.

Anything like a full and free ventilation cannot be effected without loss of ammonia and risk of nuisance. Sooner than have the place reeking with foul ammoniacal odors, and the rapid tarnishing of bright metal work, paint, etc., I prefer to put the tar well in a safe place, and to cover it down closely, using beaded covers, that can be bedded in sand or soft pitch. Accidents happen so rarely that the chances are that the presence of an explosive atmosphere in the tar well is due to exceptional causes, and not the general rule. But it is well to be cautious, and, if there is any risk, to provide a ventilating arrangement. This may consist of an inlet at ground level on one side, and an outlet, carried several feet high, on the other; and one or both may terminate in small purifying boxes charged with crystals of sulphate of iron (green vitriol), which will absorb both ammonia and sulphureted hydrogen.

Take Care of the Valves.—Next to the sealed overflows for liquid deposited in the gas pipes, the valves about a gas works require supervision, and the gas manager who does not give them systematic attention, and so keep them in good condition, is laying up for himself or his successor a sure harvest of "anxious moments." A plan showing every valve on the works should be hung in the engine room or other prominent place, and the foreman or other person in charge should fully understand it. A proper arrangement should also be made as to keys or spanners. It is very awkward, in an emergency, if nothing can be done until "Charlie" or "Tom" is fetched, who may happen to be in bed at the time, or if the key or spanner that is wanted cannot be found. At least half of the valves are situated on the main arteries of the system, and the failure of one of them means putting the whole of the operations out of gear, and stopping either the manufacture or the distribution of gas until the defect is made good. So much depends upon the efficient action of the valves that it is a good plan to keep a register, with a page for each valve, and to number the valves consecutively throughout the works, beginning with No. 1 at the outlet of the first section of hydraulic. The information afforded by a full history, giving description of valve, date when purchased, repairs since effected, and any characteristic defect or difficulty in working, is likely to be of use in case of a breakdown. Although the primary valves, as above instanced, are the more important, the secondary ones, on by-pass circuits, that can be removed or repaired without interference with regular operations, as well as those for tar, liquor, steam and water, may well be included in the list. Even in a small works the valve book assumes such proportions that the wonder is, not that trouble occasionally rises by reason of the breakdown or failure of a valve, but that such events are so few and so far between.

These remarks apply especially to valves put in on the distributing system outside the works. Frequently, if these are supplied at all, no

proper record of them is preserved, and their very existence is lost sight of. More than once have I found a valve on a line of main, and been unable to guess why it was there or what it was for. The answer to these questions would have been important had it not been that the whole of the working parts had rusted together in a mass as solid as the body of the pipe. It would have taken much longer to get the thing to work than to drill and bladder the main. On the occasion of the recent disastrous conflagration in the City of London the distributing system of the Gas Light and Coke Company received a sudden and unexpected test. How many country gas companies would be capable of emerging with equally satisfactory results from a similar ordeal? I once had to deal with a very bad compound fracture of a joining or "marrying" main, which was reported at 10 P.M. one winter night. The weather was of the kind known as "muggy." There was no wind, and the gas was escaping so freely at the surface of the ground that no one could work on it. Two courses suggested themselves; either to bladder the pipe on each side at some distance from the break, or to shut off the supply all over the district. The pressure was reduced a little lower than usual at the works, two distinct and separate gangs of men went to work, and in an hour the pipe was bladdered on both sides and the leakage stopped. Sometimes the configuration of the line of pipes is such that it is possible to block it by sealing a siphon, but this is a clumsy expedient, and unless done carefully, will mean a great many complaints about jumping lights.

Hydraulic and Dry Valves.—Hydraulic arrangements, such as Lyon's siphon, have been proposed as a substitute for valves on the distributing system. Looking at the fact that the valve is not of much use unless maintained in good order, there is much to be said in their favor. The diaphragm siphon has no moving parts, and is sure to be reliable whenever wanted; but it requires pumping at rather more frequent intervals than the ordinary form. The special object of all such arrangements is to admit of dividing the main into sections, so as to be able to test it for leakage; and this, indeed, may in country towns, be regarded as the main object, as plenty of instances might be cited where the supply has been maintained for half a century or more without any necessity arising, by reason of a large conflagration or otherwise, for either cutting off a length of main or shutting down the outlet valve.

Various patterns of single valves have been proposed from time to time, but have mostly given place to slide valves of the Donkin type, the disc being actuated by a rack and pinion, and the whole inclosed in one case. Valves having the outside rack and pinion, and a spindle working in a stuffing box, are now practically obsolete. Occasionally, the disc is made to lift from its seat by a rod attached to its center, on which is cut a long screw thread. This pattern is a modification of the old hydraulic valve, in which an inverted cup or thimble was substituted for the disc. The inlet pipe passed through the bottom and formed the inside circle of an annular space that was filled with water, or with any suitable fluid, and the valve was opened or closed by raising the cup out of, or immersing it into, the liquid. Then there are a great many different compound valves, commencing with the four-way, or by-pass, and including center valves for three or four purifiers. The hydraulic type used to be a favorite form for this kind of apparatus, but it is now entirely displaced by the dry faced system; and all who have had any experience with a frozen hydraulic center valve on a cold winter day or night will welcome the change. Another difficulty with any hydraulic valve that is exposed to foul gas is that the water rapidly absorbs sulphureted hydrogen. I have known this to obtain to such an extent that the purified gas returning through the center valve to the outlet was sufficiently fouled, by passing in contact with the water, to show a dirty test to lead paper. If the cover was made of cast iron throughout it was very heavy and clumsy, and if of wrought iron there was frequent trouble by corrosion and perforation. With regard to the valves, it may be said, with more emphasis than usual, that "the best are the cheapest."

Keep Valves Clean.—The chief enemies to be guarded against are dirt, changes of temperature and settlement. The dirt is not so much accumulations externally, in the usual way, as various foreign matters condensed from the gas or carried by a current of liquid, such as naphthaline and tarry matters, fragments of luting dropped into the pipes when taking off, or cleaning doors, or finely divided purifying material washed down from the purifiers. If not regularly removed they tend to harden and clog the working parts, so that if the valve is shut it cannot be opened, and if opened it cannot be shut.

In striving to hurriedly effect one or other of these operations there is risk of permanent injury, such as stripping the rack or breaking the pinion. Particularly in the case of valves on the dry-face principle is it necessary to preserve the gases from any foreign matter. Continued neglect of this precaution may permanently cripple the appliance. Variations of temperature mean unequal expansion or contraction, leading to leakage or to fracture; and settlements have a similar effect. These may be due either to the line of pipe close to the valve being carried through and built into a wall, or, in the case of compound valves, to their own weight. Some of these articles are very heavy and require rigid foundations, spread over an area larger than that of the valve itself. They depend for accurate and proper working upon the face being kept perfectly level and true; and a very trifling cant or settlement to one side may mean a lot of trouble. Compounding valves are a great advantage in the matter of first cost, simplicity and reliability. A 4 way dry-faced valve is cheaper, simpler and more reliable than the three single slide valves that would otherwise be necessary. The change from open to by-pass is simple and certain, and there is no risk of the trouble that may be caused by not closing or opening the valves in proper sequence. But, like other good things, it can be carried too far. The compound valve, when it comes up to 5 feet or more in diameter, and a ton or more in weight, is an unwieldy and awkward thing to deal with. It is also possible to carry too many eggs in one basket. A single center valve for four purifiers means stopping the make of gas while it is repaired, whereas with six 4-way valves, four out of the six can be laid off for repair without interfering with the make and purification.

Flaming of Oil Spray and Explosion of Dust.

The *American Exchange and Review* says that two recent Massachusetts fire outbreaks were of these respective characteristics:

First, The Central Massachusetts electric light plant at Palmer, burned under complications of hazards which involve both the beginning of the fire and its progress in uncertainty—from the flame start in the wheel room to the final destruction less than an hour elapsed. The plant was not insured by mutuals, but a Boston manufacturer's mutual gives this theory of the flaming apart from any electric contribution to the same:

The building destroyed was of frame construction. The protective appliances comprised a hydrant system supplied by a No. 6 Fales & Jenks rotary pump located in the wheel room. The fire occurred about 9 A.M. The station furnished current for lighting solely, and for this reason a considerable portion of the plant was shut down quite early in the morning, and the plant was entirely shut down during daylight. The power was furnished by water wheels. The superintendent found that the pressure on the Lombard water wheel governor had dropped below that required, and he had gone to the station with his assistant to get the governor in condition for running the plant that night. This governor comprises an oil pump which, when in service, is under from 200 to 250 pounds pressure, and delivered the oil into a 12-inch receiver. It is intended to keep the receiver about half full of air, so that the oil may be quickly delivered into the working cylinders of the governor. Direct testimony cannot be obtained as to just what happened, for both the superintendent and his assistant were severely burned by the fire.

So far as can be found out the conditions were as follows: The power had been started so as to operate the governor and its oil pump and the pressure had been brought up to the required amount. The air relief valve opened properly and the wheels were being shut down. Just at this time something happened which allowed oil to be delivered into the room, and the whole place was instantly full of fire, and as the main belt was slowly moving this fire was carried directly into the main room of the station. The two men got up by breaking through a window, and after they had extinguished the fire in their clothing by jumping into the canal, they telephoned the town fire department for assistance. A steamer was sent down, but as the station is something over a mile from the town and beyond any of the street mains, much time elapsed before any water was put on to the fire.

As the fire started in the wheel room the fire pump could not be used. The fire destroyed the wheel and pump house and the dynamo room, but the brick fire wall which separated the dynamo room from the boiler house saved the westerly portion of the plant. The fire lasted about three-quarters of an hour. The property was visited in company with the inventor of the governor, as well as the chief engineer of the makers, but so much of the parts of the governor had been destroyed that evidence as to just what happened could not be obtained. The receiver was examined and was not burst. The oil pump was found with one of the heads gone, but the cylinder had evidently received a hard blow, and the conditions were such that it could not be told when or how this head had been removed. The governor is especially well made

and is tested by a pressure much in excess of the ordinary working pressure, and it may be that more oil had been used than was required and the pump was working against practically a dead end as a pressure pump.

Experiments made by a concern which is insured by these companies, and which has a number of these governors in service, show that the air contained in the governor is not explosive and does not contain combustible gases. The oil which is furnished with the governor is a mineral oil of high fire test, usually a little heavier than spindle oil, but it is not known just what oil was being used in this plant. The buildings were heated by stoves, and there was a stove in this room. At present the most reasonable explanation is that the fire started from oil coming in contact with the stove, and it is likely that some portion of the governor, which was under 200 or more pounds pressure, leaked or burst and allowed oil to be sprayed into the room. If this was the case, as the governor holds some 15 or 20 gallons, this amount of oil may have been delivered into the room by the air pressure in the tank.

Then a grain dust explosion, at Charlestown, made about a $600,000 loss, through explosion and fire, and left nothing undetermined as to how the destruction was effected, though there may be a question as to what was the loss by "explosion" and what was the loss by "fire"—fire burning the value left after the explosion. A report of the result is as follows:

An explosion of dust at 4 A.M., April 17, blew off completely the roof of the grain elevator at the Hoosic Tunnel Docks, and the fire that followed not only destroyed the remaining portion of the immense structure, but consumed nearly the entire contents of about 400,000 bushels of grain, mostly wheat. Some of the small tenancies adjoining and a building used as a distillery by Chapin & Trull were damaged more or less by the debris from the roof.

The explosion not only shook the entire section of Charlestown, but was noticeably felt in the city proper and many of the suburbs. Coming at such an early hour, the tremendous jar aroused half the city. Three-quarters of the fire department, including the two horseless engines and fire boats, were soon massed in the immediate vicinity.

When the first firemen arrived they found some of the streets impassable, for portions of the roof were in every direction. Great timbers had been blown a hundred feet in the air by the force of the explosion, and many of the upper stories of neighboring property were crushed and pierced by the great beams. The fire burned fiercely for nearly four hours, and when it was extinguished there was only a shell of the structure left, while bursting from every side were tons and tons of wheat and oats. Much of the grain fell through the pier to the dock, while practically the whole of it was so thoroughly soaked with water that the loss will be complete. The grain was valued at about $350,000; insurance $200,000. The loss on the structure is $150,000; insurance $104,000, and the damage to the piers and adjoining property is about $50,000.

As to adjustment and settlement of explosion losses, it is said that the following agreement has been entered into in some cases:

Whereas the loss is alleged to have occurred on the 17th day of April, 1898, to property described in policy No...., of the....., and there is doubt as to whether or not the said company is liable for the said loss, and the person named as insured in said policy is anxious to have the amount of the alleged loss agreed upon or ascertained at once, leaving the question of the liability of the said company to be determined later:

Now, therefore, it is agreed by both the above parties that no action of the said company, or of any of its agents, in ascertaining the amount of the loss, or in agreeing upon its amount, or in making up or receiving proofs, or in entering into reference proceedings, or in negotiating for a compromise settlement, shall in any way be construed as an admission of said company's liability of said alleged loss, or in any way affect the company's right to deny its liability for any or all of the said alleged loss; and that no such action shall in any way affect the said company's right to proofs of loss, to an ascertainment of the amount of the loss by reference, and, in brief, to any right which the company now has, or shall hereafter have, by virtue of its said policy, or otherwise, of whatever name, kind, or nature.

And I, the mortgagee named in said policy, hereby agree to be bound in all respects by the within agreement.

Thus two phases of hydrocarbons showed their respective flammabilities, and comminution energizes combustion. Explosion may be without flash light according as the combustive energy is about totally transformed into heat, and flame is the light of non-instantaneous combustion—that is, delayed dissociation of elements with recombinations. Grain as an inflammable and an explosive is indicated by the circumstance that by distillation a given weight of wheat yields a spirit that is 45 per cent. alcohol, which in weight is about 40 per cent. of that of the wheat; maize nearly the same; rye about 36 per cent. In the two fires cited, some of the grain was at the highest point of attenuation; none of the oil was. Powdered grain, according to its fineness, may be deposited on surfaces or float in the air; the former flames, the latter explodes.

The ascending fire force of the two subjects noted may be described as of the following stages of attenuation:

Grain.	Oil.
Seed,	Liquid in volume,
Granules,	Drops,
Powder,	Spray,
Dust.	*Vapor.*

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the stockholders of the Easton (Pa.) Gas Company the following Directors were elected: W. A. Bush, W. G. Stewart and E. A. Depew, to serve three years; and Jeremiah Anglemeyer, to serve one year. The Directors subsequently perfected the following executive organization: President, Samuel Boileau; Secretary, W. G. Stewart; Treasurer, E. S. Lawall; Superintendent, Wm. H. Ward.

Mr. James Noonan, for many years in the employ of the Washington (D. C.) Gas Light Company, died at his home, No. 1025 22d street, Washington, on the afternoon of the 4th inst. Deceased was in his 70th year.

The offices of the Poughkeepsie (N. Y.) Gas Company have been removed to No. 35 Market street. The Company has virtually decided to alter its plan of collections from the quarterly to the monthly system, which determination looks to us in line with sound business practice.

At the annual meeting of the Hanover (Pa.) Gas Company the officers chosen were: Directors, R. M. Wirt, H. Y. Sprenkle, L. F. Melsheimer, R. Young, G. M. Forney and A. M. Bucher—the latter takes the place of the late Mr. Stephen Keefer; President, A. W. Eichelberger; Secretary and Treasurer, Geo. N. Forney.

The Council of Tryone, Pa., has determined that the sum asked by the proprietors of the Tyrone Water and Gas Company—it is proposed to operate the named plants on municipal account—for their properties is excessive. The next step taken was to instruct the Law Committee of Council to condemn the plants in accordance with the governing Pennsylvania statutes.

The marked increase in output that has followed the intelligent business methods of the proprietors of the Northwestern Gas Light and Coke Company, of Evanston, Ills., has obliged them to increase their manufacturing facilities. The result of their deliberations in this instance was the placing of a contract with the Western Gas Construction Company, of Fort Wayne, Ind., for a complete setting of the Construction Company's improved Lowe double superheater water gas apparatus, equal to the production of 700,000 cubic feet per day. The contract also calls for a Roots exhauster and engine on the same bedplate, with pipe connections and bye pass; also, special fittings for an old holder, which is to be used as a relief receiver for the new water gas apparatus.

A Wisconsin correspondent, who writes under date of the 5th inst., and who signs himself "Ignorance"—which is very much of a misnomer—asks:

To the Editors American Gas Light Journal: Kindly state in a prominent space in the next issue of the Journal, that it would be intensely interesting to know what per cent. of the heat contained in the fuel fired in a coal gas bench is transmitted through the retorts, and made to do useful work. The writer asks this question for the sole purpose of acquiring information, and not with the idea of catching some one in a trap. One set of figures now before me would indicate that a coal gas bench, under fair working conditions, has an efficiency of considerably less than 20 per cent., computed on the most liberal estimates. Our electrical competitor often realizes an efficiency of 70 per cent. in his boiler room, and if we are utilizing such a small amount of heat as seems apparent, it would look desirable that we direct our attention towards refining this division of our operations.

It is reported that the Macon and Indian Spring Railway Company, of Macon, Ga., has arranged for the purchase of the electric lighting plant of the Macon Gas Light and Water Company.

The wideawake proprietors of Ogontz Park, Ogontz, Pa., a tract of 43 acres being developed near Philadelphia for high grade residential purposes on the suburban order, are arranging with the new Jenkintown and Cheltenham Gas Company, of Jenkintown, nearby, for the laying of gas mains throughout all the streets and avenues of the Park. The owners of this property know that towards the attraction of future property owners a good supply of gas, available for all purposes, is a potent factor. They are are also shrewd enough to plan for lighting their streets and avenues—some two miles total—to the best advantage, yet economically; 75-candle power Welsbach lights, in attractive Boulevard posts, having been decided upon, to the discomfiture of 24-candle power electric lamps, first contemplated.

The annual meeting of the Bristol (Pa.) Gas Light Company was in every sense satisfactory to the shareholders, the annual report having shown that the business for the year was done at a good profit. The officers chosen were: Directors, Dr. H. Pursell and Messrs. Louis A. Hoguet, James Buckman, H. B. Beatty and Edward Swain; President, Louis A. Hoguet; Secretary, H. Pursell; Treasurer, H. B. Beatty.

A reduction in the selling rate, by the Attleboro (Mass.) Gas Company, has been agreed upon, the concession to take effect next June, provided that at the annual meeting the preliminary action by the Directors is ratified by the stockholders.

Mr. Albion K. Pierce, Superintendent of the Belfast (Me.) Illuminating Company since 1868, died at his home in Belfast on the morning of the 2d inst. Deceased was in his 76th year.

At the annual meeting of the Westerly (R. I.) Gas and Electric Light Company, the Directors chosen were: Edwin Babcock, Peleg Clark, A. L. Chester, George H. Utter and William Segar.

Messrs. Bartlett, Hayward & Co., of Baltimore, have been awarded a contract by the Massachusetts Pipe Line Company, for the construction of a 5,000,000 cubic foot capacity gasholder on the Pipe Line Company's proposed works at Everett, Mass. The holder, which is to rest in a steel tank, is to have four lifts, and a diameter of 200 feet. When fully inflated the holder will rise to a height of 230 feet.

The proprietors of the Southbridge (Mass.) Gas and Electric Company have agreed to supply gas on fuel account at the rate of $1.50 per 1,000 cubic feet.

The Board of Gas and Electric Light Commissioners has consented to the issuing by the Pittsfield Electric Company, of $25,000 additional stock and $100,000 additional bonds.

The Buffalo (N. Y.) Contracting Company has been incorporated, with a capital of $10,000. It proposes to build gas works, lay gas mains, construct sewers, and to engage in a general way in the construction business. The Directors for the first year are Messrs. P. N. Griffin, T. Guilford Smith, Peter Young, John D. Shattuck and H. P. Bissell.

A correspondent at Springfield, Ohio, forwards the following: "The old St. John Machine Company's building, on the corner of Main and Center streets, Springfield, is being fitted up for occupancy by the Springfield Gas Company. Mr. P. M. Cartwell, the present owner, is having a fine, new plate glass front put in, and a new maple floor is being laid. The room will be occupied as offices by the natural and artificial gas companies. At the time of the consolidation of these two companies about two years ago the Springfield Gas Company became and is the owner of both the gas plants. The natural gas plant was leased to the Central Contract and Finance Company, which lease expired recently, and the entire business will in the future be managed by the Springfield Gas Company at its new office. The change will enable the Company to manage its business more economically and save its patrons the trouble of going to two offices. The natural gas now being supplied in Springfield is purchased from the Ohio Pipe Line Company and comes from the Fairfield county fields. The gas is the best that has yet been discovered. It is entirely free from all impurities, the supply is large, and the indications are that Springfield will have plenty of natural gas for years to come. Governor Asa L. Bushnell is President of the Company, and Col. J. W. R. Cline is Secretary. The management of the entire business has been placed in the hands of Col. Cline, who is known all over the country as one of the most competent managers in the gas business in the State. Mr. E. D. Abbott will be the outside Superintendent of the combined Companies."

Burgess Davidheiser, of Pottstown, Pa., has vetoed the franchise recently granted to the projectors of the Citizens Gas Company, who proposed to operate an opposition plant in the place named.

The next likely giving up of municipal control of a lighting plant will be recorded at Alexandria, Va., where it is proposed to turn the gas works over to private enterprise.

The reorganization of the gas and electric lighting properties at Decatur, Ills., has finally been perfected. The concern is to be known as the Decatur Gas and Electric Company, capitalized in $400,000. The officers are: Directors, George C. Danforth, Joseph Housmer, W. C. Johns, James B. Wheeler and Homer W. McCoy; President, George C. Danforth; Secretary, Joseph Housmer; Treasurer, W. C. Johns. The selling rates for gas are to be thus adjusted: For an illuminating supply, $1.25; for a supply on fuel account, $1 per 1,000.

The Worcester (Mass.) Gas Company has arranged for a series of lectures on cooking by gas, Miss Anna Barrows having been engaged to make the demonstration. The lectures will be given in the pleasant and well arranged hall in the Company's handsome, new office building.

The contract for city lighting at Lockport, N. Y., has been awarded to the Lockport Gas and Electric Company, the agreement to run for three years. Electric arcs to the number of 250 are to be maintained, the lighting to be done on a partial moontable, at the rate of $78 per lamp per annum, and 96 gas lamps are to be maintained, at the rate of $17.50 per lamp per annum.

At the annual meeting of the South Side Gas Company, of Pittsburg, Pa., the officers chosen were: Directors, M. Maloney, G. W. Elkins, W. A. Heyl, Joseph E. Walter, H. V. Messler, Samuel F. Bodine and J. R. Kiel; President, Robert D. Brown; Secretary and Treasurer, W. H. Alldred.

Mr. A. W. Guthrie has instituted a suit for damages against the Capital City Gas Light Company, of Des Moines, Iowa. He owns property adjoining its plant on the East Side, and claims that through the carelessness of the Company the renting value of the property has been ruined. He asserts that a well which formerly yielded pure water now yields a mixture of oil and water, the contamination arising from imperfect drainage on the Company's works. He further claims that gas escapes from the Company's holders render the houses nearly untenantable.

At the annual meeting of the Altoona (Pa.) Gas Company the officers chosen were: Managers, John Lloyd, H. C. Dern, T. Blair Patton, Jno. R. Bingaman, A. C. Shand and W. C. Leet; President, John Lloyd; Treasurer, J. A. Ritchey.

At the annual meeting of the Detroit Gas Company the following officers were elected: Directors, John C. Donnelly, D. M. Ferry, Eugene P. Lynch, W. H. Wells, Wm. C. McMillan, F. S. Smith, Emerson McMillin, C. P. Huntington, Thos. H. Hubbard, M. W. O'Brien, Jno. Byrne, W. F. Douthirt and C. F. Scoville; President, Emerson McMillin; Vice-President, W. C. McMillan; Secretary, Jno. C. Donnelly; Treasurer, M. W. O'Brien; Assistant Treasurer, W. F. Douthirt; General Manager, Henry D. Walbridge; Assistant General Manager, Philip Cross.

The application of the projectors of the Citizens Gas Light and Fuel Company for a franchise to operate in Amsterdam, N. Y., has been strangled.

The Board of Public Works, of Evansville, Ind., has granted a franchise to the Evansville Gas and Electric Light Company, under which it may plant poles and string wires for the conveying of electric currents in the district named, the grant to remain operative for 25 years. The Company agrees to pay to the city 2 per cent. annually of its gross receipts from the sale of electricity for *heat* and *power*. It is also agreed that whenever a general ordinance shall be enacted that applies to all companies, fixing the price to be charged for electricity for heating and power purposes, the Company is to be bound by such

ordinance; otherwise no restriction as to price that may be charged is specified.

At the annual meeting of the Roanoke (Va.) Gas and Water Company the Directors chosen were: C. H. Clark, F. J. Kimball, J. H. Dingee, Thos. B. Shriver, A. J. Dull, H. S. Trout and H. E. Gerhardt.

The reorganized Decatur (Ills.) Gas and Electric Company will make notable extensions this season. Prominent in the scheme is an addition to the main system amounting to a stretch of 8 miles.

Mr. Thomas Biddle, Secretary of the Toledo (Ohio) Gas Light and Coke Company, notifies the holders of the Company's 6 per cent. bonds that the same, under the provisions of the mortgage, have been called for redemption. The principal is payable at the Second National Bank, Toledo, on and after November 1, 1898, at which date interest ceases.

A correspondent at Detroit forwards the following: "Joseph Walker wasn't nearly as old when he came out from Ireland as he is now. Over 50 years have passed since he kissed the blarney stone or gathered the four-leaf shamrock in some shadowy vale. Forty years have also passed over his good head since, in the city of Shreveport, parish of Caddo, Louisiana, he took an ironclad oath of allegiance to Uncle Sam, a copy of which he has worn next his heart ever since. In an old record the writer has seen where he was elected a trustee of that town, away back in the sixties. Mr. Walker came to Port Huron in 1871 or 1872, and for 25 years has been connected with the Port Huron Gas Company, as Manager and Superintendent, and it has been an honorable record all those years of manly endeavor and square dealing. It is a pleasure to be able to speak thus kindly of this genial and whole-souled citizen of Port Huron, upon the occasion of his entering into business on his own hook. He has purchased all the right, title and interest, as the lawyers say, of the Port Huron Gas Company's plumbing business, and from now on will give it his close personal attention. Mr. Walker's long experience will serve him to good purpose in this kind of work. There is not a detail of the plumbing business with which he is not familiar, and he may be intrusted to put up a first-class job when called on. 'Joe.' Walker has many friends in this city who will be glad to see him prosper."

The unearthing of a musty gas charter, which it is said forms part of the belongings of the late Newark (N. J.) Gas Light Company, has caused much thought on the part of those concerned in the game to "solidify" the gas interests of central New Jersey. At a later date we will have something to say respecting the proposed "solidification," and as a starter we herewith reproduce the terms of the charter that has been disinterred by Mr. Vanderpool and his friends. The document, which seems to confer powers of much amplitude, reads:

"An Act to incorporate the Oxy-Hydrogen Company of the United States. Approved April 4, 1873.

"1. That Theodore Weston, Lemuel H. Davis, Benjamin G. Clarke, John S. Irick, Samuel H. Grey, William J. Sewell, Daniel Dodd and John C. Bullitt, and all and every person or persons who may become stockholders in the capital stock hereinafter mentioned, their successors and assigns, are hereby constituted and made a body politic and corporate, in fact and in law, by the name of the Oxy-Hydrogen Company of the United States; and by that name shall have power to sue and be sued, to plead and to be impleaded, to contract and to be contracted with, and to purchase, hold, lease, receive licenses, sell and dispose of any patent or patents for the manufacture of oxygen or hydrogen gas, or either of them, and their combinations with other gases, for illuminating, heating and all other purposes, and to issue its stock at par in payment for such purchase, lease or license, and to grant licenses under and dispose of said patents or rights under such patents within this State or elsewhere, and, for the purposes aforesaid, to purchase, hold, sell, convey, mortgage, lease and otherwise dispose of personal or real estate, and that the said corporation is hereby empowered to lay pipes and conductors, with all appurtenances thereto, and erect the necessary posts and lights in any and all the roads, streets, highways and public grounds in the State of New Jersey, and do all things necessary for the purpose of lighting the same, and all dwellings, stores, mines, tunnels and other places; provided that public travel shall not be unreasonably and unnecessarily obstructed thereby, and that the said corporation shall put such streets, roads, highways and public grounds in as good condition as the same were before laying said pipes and erecting said posts.

"2. That the capital stock of said Company shall be $50,000, with power to increase the same, as a majority of the stockholders may from time to time determine, divided into shares of $100 each, which shares shall be deemed personal property, and to be transferrable in such manner as shall be prescribed from time to time by the by-laws of the Company.

"3. That the property and affairs of said Company shall be managed by a Board of Directors, not less than three or more than seven in number, to be chosen annually at the time and place appointed by the stockholder or such stockholders as shall attend for that purpose, in person or by proxy, each share of the capital stock entitling the holder thereof to one vote; that said Board shall organize by appointing one of their number to be president, and a suitable person to be secretary, and may appoint such officers and agents as they may deem necessary, and may fix their duties, powers and compensations, and that the persons named in the first section of this Act, or a majority of them, may open books of subscription to the capital stock of said corporation at such time and place, in the State of New Jersey, as a majority of them may think proper; and whenever $50,000 of the stock shall have been subscribed, and 1 per centum thereof paid in, it shall be lawful for the said corporation to commence business, and the above named persons or a majority of them may give notice of a meeting of stockholders to elect Directors of said Company, who shall continue in office from the date of said election, and until others are elected in their stead.

"4. That the Directors from time to time may make such laws, rules and regulations as they may deem expedient for the government, management and disposition of the stock, effects, property, lands, profits and concerns of said Company, not contrary to the Constitution of this State or of the United States.

"5. That this Act shall take effect immediately."

Fire at the Central Telephone Station, Zurich.

Engineering says, through a communication by Mr. C. du Riche Preller, that on April 3d the Central Telephone Station of Zurich was totally destroyed by fire under very remarkable circumstances. During the night there had been an extremely heavy snowfall, in consequence of which the telephone wires all over the tower had become so weighted with moist snow that they fell in all directions, and some of them, falling about 9 A.M., came in contact with the overhead wires of the electric tramways.

The Central Telephone Station occupies a prominent position about midway of the principal avenue leading from the main line railway terminus to the lake, and comprises, besides the inter-urban and long distance lines, about 5,000 local wires, the connections being disposed in one room, about 100 feet in length, on the top floor, and served by a staff of about 50 female attendants. At about 9 A.M. one of the female attendants, when in the act of connecting two of the wires, received a violent shock and fainted, while other attendants were unable to make connection owing to violent sparking. Immediately afterwards all the wires in the long room began to glow; the paper and guttapercha insulations ignited and were reduced to cinders, the woodwork caught fire, and in the space of less than 10 minutes the whole room was alight, so that the female attendants had only just time to escape. Soon afterwards the fire extended to the garret, and the flame burst through the roof, but thanks to the exertions of the fire brigade, the fire was confined to the upper floors of the building, though the lower floors were completely gutted.

The whole of the telephone apparatus, and also a great many telegraph apparatus, were completely destroyed, and the damage in the Central Station alone is estimated at 1,000,000 francs, irrespective of the considerable damage done to the telephone lines all over the town, in consequence of the snowfall. The consequence is that not only local telephonic communication in Zurich, but also long distance communication is, and will be, interrupted for several weeks, if not months.

As the fire broke out in consequence of telephone wires coming in contact with the tramway lines, the tramway current at 500 volts pressure thus rushing into the central station, it might be argued that the liability for the damage lies with the electric tramway. During a similar recent snowstorm at St. Gall, telephone wires fell on the tramway contact lines in several places, and, in one instance, a man was killed. The Corporation of St. Gall, which owns and works the electric tramways of the town, promptly declined all liability, and claimed damages from the Federal Telephone Department. This claim appears more justifiable as the Swiss Telephone Department imposes on all electric tramway undertakings very heavy contributions for displacing, doubling or otherwise improving existing telephone lines which cross or run in proximity to electric tramways.

(*Continued on page* 783.)

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It therefore appears only fair to expect that the telephone lines should either be so placed as to preclude the possibility of contact with the tramway lines, or that they should be put underground, as has already been done in some sections where the tramway and telephone lines run parallel to each other.

There is considerable conflict of evidence as to the exact point where the short circuit occurred. There are four different and independently worked electric tramway lines at Zurich, and in the opinion of the writer, who witnessed the fire, there can be no doubt that short circuits occurred on all the lines, and probably at various points of the same, seeing that in the case of such an exceptional heavy snowfall, even the transverse catch wires, which are intended to prevent the telephone wires from falling on the tramway lines, are liable to break under the weight of the snow, and hence afford no protection.

The destructive fire will teach one salutary lesson, namely, that in a large town like Zurich, the enormous extent of the overhead telephone system is, owing to the small cross section, and the consequent inability of the wires to support the weight of snow, liable to become a far greater source of danger than the overhead tramway lines, on which the snapping of a wire is, comparatively speaking, an extremely rare occurrence. It speaks volumes for the overhead contact lines, that during the exceptional snowfall which proved so fatal to the telephone system, there was no accident of any kind on the electric tramway.

As the extensive system of horse tramways at Zurich, recently acquired by the town, is about to be reconstructed for electric traction, the Corporation will, no doubt, insist upon the Federal Telephone Department placing all the telephones underground. The expenditure will be heavy, but the remedy will be effectual, and it will preclude the contention which has been and is frequently advanced, that electric tramways are responsible for the defects inherent to overhead telephone lines.

The strains to which telephone wires are subjected when they are weighted with snow or ice, may be gathered from the fact that in Switzerland, even after an ordinary snowfall, or during frost, the snow or ice deposit on a telephone wire 2 millimeters in diameter, often attains a diameter of 30 millimeters, or 15 times that of the wire. During the recent extraordinary fall of snow heavily charged with water, it was observed at the Meteorological Office at Zurich that the snow deposit on telephone wires reached a diameter of no less than 60 millimeters, or 30 times that of the wire, the cross section of the deposit being, therefore, roughly, 3,000 square millimeters. Taking the specific gravity of the moist snow deposit at one fifth of the volume, we have for a span of 100 meters, a snow weight of 60 kilogrammes, or more than 20 times the weight of the wire (2.8 kilogrammes per 100 meters). Many of the telephone posts at Zurich support iron frames carrying as many as 250 wires, the snow weight on them being, therefore, for a span of 100 meters, no less than 15 tons, or 20 times more than the weight in copper. Under these circumstances, it is not surprising that several of these posts bent or broke over like reeds, and that the wires, too, were unable to support the strain; the less so as their normal resistance became suddenly reduced by the rapid and abnormal fall of temperature below zero.

Petroleum Briquettes.

In a process for making petroleum briquettes, described in Kuhlow's, petroleum refuse is worked up in such a manner as to assume the form of a solid substance, easily handled and constituting a cheap and convenient fuel. About 10 per cent. of soda lye, with about 10 per cent. of any fatty matter—tallow, for instance—is heated in a boiler, either by superheated steam or with exclusion of air; and so much petroleum refuse is then added to the heated mass as to make up 100 parts. The whole is heated with constant stirring for about an hour, the time varying with the mode and intensity of heating; but the temperature must never be allowed to reach the boiling point of petroleum, because in that case a large quantity of froth would form. In this incipient state of saponification the mass acquires the property of taking up large quantities of very fluid rock oil, and, if this incorporation of the mass should proceed too slowly or remain incomplete, it may be hastened by the addition of a little soda lye.

In a short time the saponification of the grease with the fixing of the petroleum will be effected, and the mass thus produced may be run into moulds and allowed to cool, when it may be cut into pieces of any desired form.

According to the use for which the briquettes are destined, they can during manufacture receive the addition of coal dust, sawdust or other refuse, and, if it be desired to obtain a product of less firm consistency, the grease may be entirely or partially replaced by resin or resin acid, the product in either case having a content of more than 80 per cent. of petroleum, more than 90 per cent. of combustible substances, and less than 5 per cent. of incombustible residue.

The Market for Gas Securities.

The market for city gas shares is widening, and the increase in business has been done at very much better prices. Consolidated yesterday sold up to 193¼, but subsequently eased off to 191¼, and opened to-day (Friday) at 192. The Stock Exchange has admitted to its trading list $500,000 additional of the stock of the Consolidated Company, which stock President Gawtry calmly informed the Committee on Stock List, New York Stock Exchange, had "been sold in pursuance of a resolution of the Finance Committee, adopted Feb. 25, 1898."

It is further said that "the proceeds of the sale of these shares are to be used for the purpose of meeting maturing bonded indebtedness and for extensions and improvements." These particulars must be most pleasurably welcomed by the "ordinary stockholders," or those not in the charmed circle of the Company's Finance Committee; for they (the particulars) convey so much to the people not on or of the Committee. The stock is sold, and it is admitted to the list, but who bought it, or got it, or the price paid for it—well, the Committee doesn't say much in respect thereof. Meanwhile our belief is that "ordinary shareholders" should keep whatever shares they own, since it is our idea that Consolidated is worth intrinsically very much more than twice par. All other city shares made sharp advances, notably Mutual, which moved to 320 bid, and Standards, common and preferred, which are 139 and 158 bid, respectively.

Brooklyn Union is at the very much more reasonable figure of 120 to 121 than the ridiculously low prices which have ruled in it since February. Baltimore Consolidated holds up well, but it is cheap at the quoted rates. The list in general shows marked gains, save in the instance of Bay State, the lethargy in which has almost reached the lethal stage.

Gas Stocks.

Quotations by Frederic H. Cochran & Co., Brokers and Dealers in Gas Stocks.

20 AND 22 BROAD STREET, NEW YORK CITY.

MAY 16.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	192	..
Central	500,000	50		..
" Scrip	220,000	..	100	.
Cental Union, Bonds, 5's	3,000,000	1,000	99½	100
Equitable	4,000,000	100	206	215
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	,500,000	100	320	3 0
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	28¾	..
Preferred	10,000,000	100	67¼	..
Bonds, 5's	11,000,000	1,000	98	..
Northern	150,000	50		
" Bonds	150,000	1,000	..	
Northern Union, Bonds, 5's	1,250,000	1,000	94½	95½
New York and East River	5,000,000	100	81	83
Preferred	2,000,000	100	113	115
Bonds 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	106

Richmond Co., S. I.	348,650	50	70	..
" Bonds.	100,000	1,000	..	..
Standard	5,000,000	100	139	..
Preferred	5,000,000	100	158	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	150	121
" " Bonds (5's)	15 000,000	1,000	111	114
Bay State	50,000,000	50	8	3½
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	89	90
2d " " "	3,000,000	1,000	..	70
Buffalo City Gas Co.	7,000,000	100	97	..
" " Bonds, 5's	7,000,000	1,000	90	92
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	89	91
1st Mortgage	1,085,000	..	101	103½
Consumers. Jersey City	2,000,000	100	75	80
" Bonds	600,000	1,000	103½	105
Cincinnati G. & C. Co.	8,500,000	100	200	201
Consumers, Toronto	1,500,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	60¾	61¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		48	51
" Con. Bonds	4,312,000	..	..	95
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78	81
" Bonds	2,000,000	..	89	91
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	115	125
" Bonds, 6's	2 650,000	..	106	107
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	78	83
Bonds	1,000,000	1,000	90	91
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	47	..
Preferred	2,500,000	100	86	90
Bonds	9,034,400	1,000	103	103¼
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	2,500,000	25	17	19
Bonds	1,000 000		94	97
Washington, D. C	2,000,000	20	220	
Western, Milwaukee	4,000,000	100	77	78¼
Bonds, 5's	3,556,000		102½	103½
Wilmington, Del.	550,000	50	200	

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The undersigned, as Receiver, will, on Tuesday, the 31st day of May, A.D. 1898, at the north door of the Court House, in Girard, Crawford County, Kansas, offer for sale to the highest bidder for cash at time of sale, the gas and electric light plants of the Pittsburg Gas Light and Coke Company, of Pittsburg, Kansas, which comprises one-half block in the center of the city, with the improvements and machinery thereon, and the gas and electric light systems of the city of Pittsburg. The Pittsburg Gas Light and Coke Company is a Kansas corporation with a capital stock of $100,000. The property will be sold subject to outstanding bonds in the sum of $52,500, and for not less than sufficient to pay outstanding Receiver's certificates and expenses, and costs, which at the time of sale will approximate $13,000. The gross yearly income from the plants averaged $19,000 for the past two years, and improvements to the amount of $10,000 have been added to the property during that time. The Gas Company has a lighting contract with the city that has yet 10 years to run, that pays about $5,000 per year. Pittsburg, Kansas, in March, 1897, had a population of over 12,000. It has since increased. It is in the center of the coal and zinc region of Southeastern Kansas, and is the most progressive and thrifty city in the State. During the year ending March, 1897, the population increased upward of 2,000. The property is desirable for any one seeking that kind of investment. For further particulars address the undersigned,

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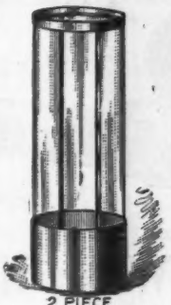

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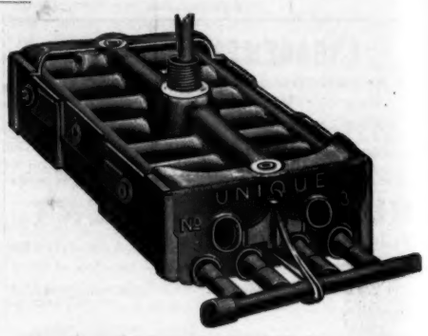

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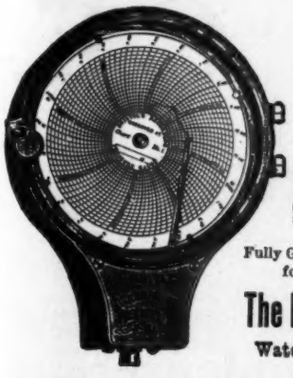

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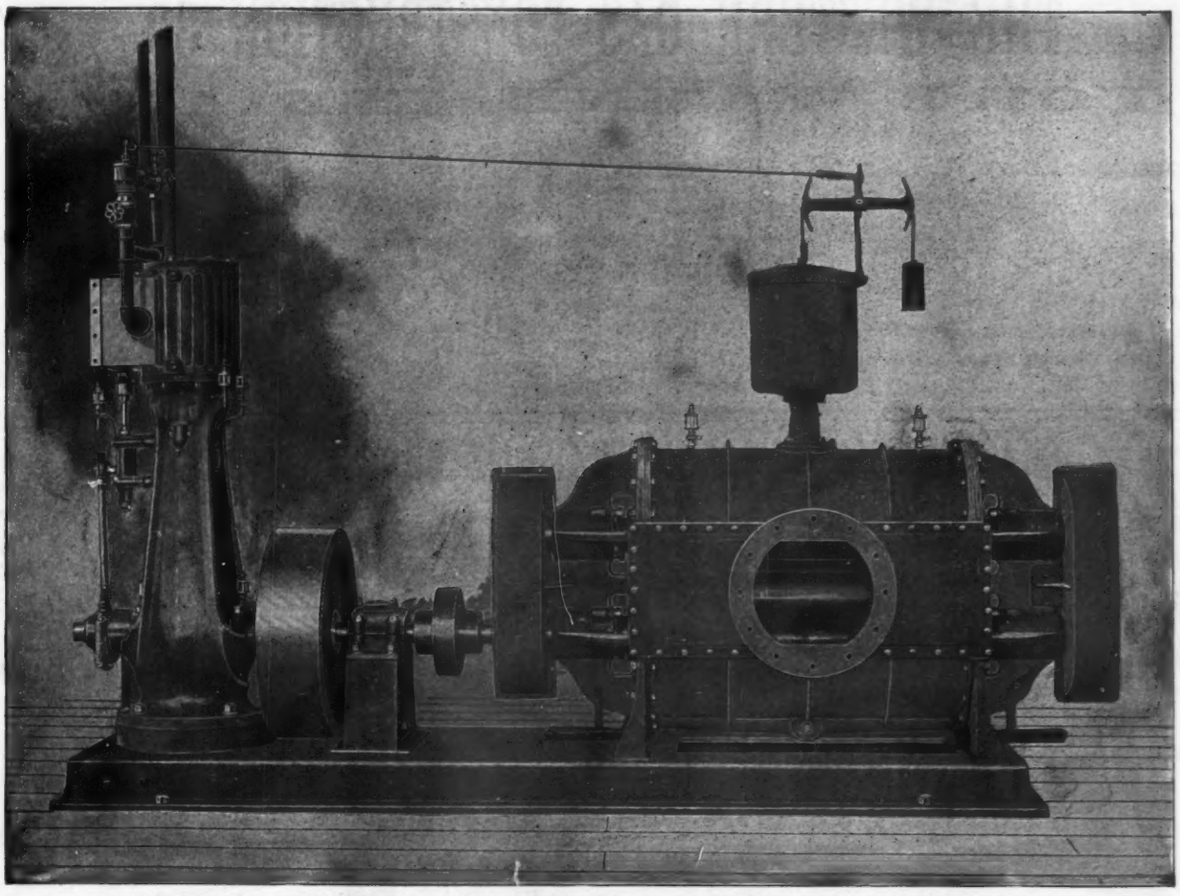

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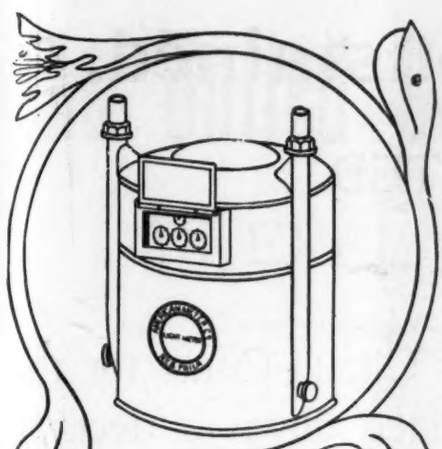

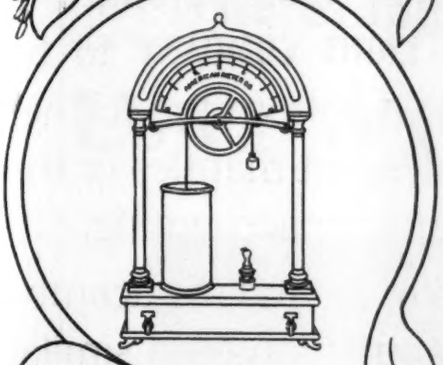

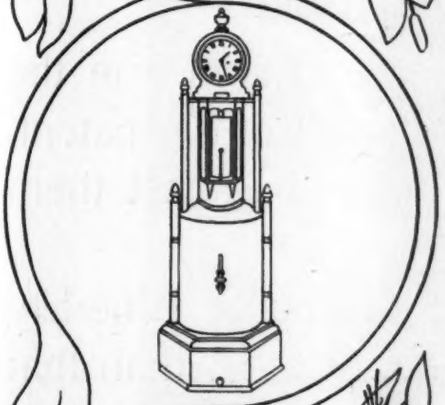

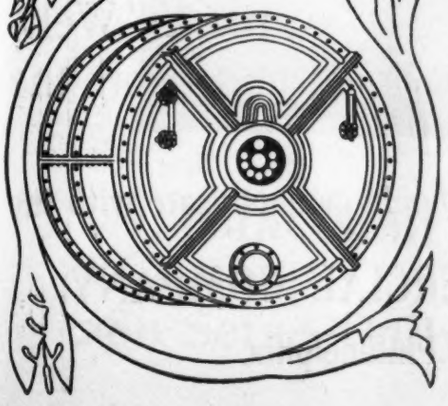

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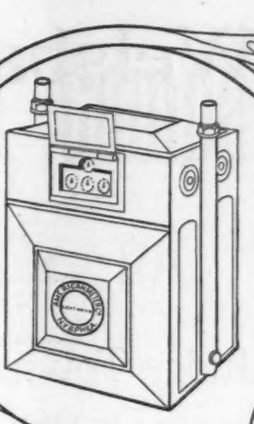
PUBLIC LIGHTING TABLE.

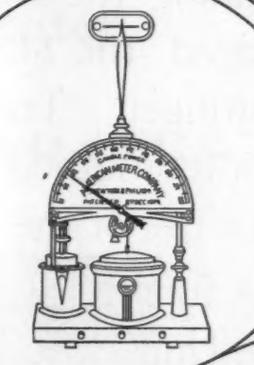
JUNE, 1898.

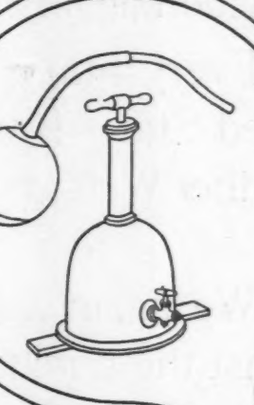
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Wed.	1	1.30 AM	3.30 AM	7.15	3.15
Thu.	2	2.20	3.30	7.15	3.15
Fri.	3	No L.	No L.	7.15	3.15
Sat.	4	No L. FM	No L.	7.25	3.15
Sun.	5	No L.	No L.	7.25	3.15
Mon.	6	8.00 PM	10.50 PM	7.25	3.15
Tue.	7	8.00	11.30	7.25	3.15
Wed.	8	8.00	12.00	7.25	3.15
Thu.	9	8.00	12.30 AM	7.25	3.15
Fri.	10	8.00 LQ	1.00	7.25	3.15
Sat.	11	8.00	1.20	7.25	3.15
Sun.	12	8.00	1.50	7.25	3.15
Mon.	13	8.00	2.10	7.25	3.15
Tue.	14	8.00	2.40	7.25	3.15
Wed.	15	8.00	3.30	7.25	3.15
Thu.	16	8.00	3.30	7.25	3.15
Fri.	17	8.00	3.30	7.25	3.15
Sat.	18	8.00 NM	3.30	7.30	3.15
Sun.	19	8.00	3.30	7.30	3.15
Mon.	20	8.00	3.30	7.30	3.15
Tue.	21	8.00	3.30	7.30	3.15
Wed.	22	8.00	3.30	7.30	3.15
Thu.	23	9.10	3.30	7.30	3.15
Fri.	24	9.40	3.30	7.30	3.15
Sat.	25	10.00	3.30	7.30	3.15
Sun.	26	10.30 FQ	3.30	7.30	3.15
Mon.	27	10.50	3.30	7.30	3.15
Tue.	28	11.30	3.30	7.30	3.15
Wed.	29	12.00	3.30	7.30	3.15
Thu.	30	12.50 AM	3.30	7.30	3.15

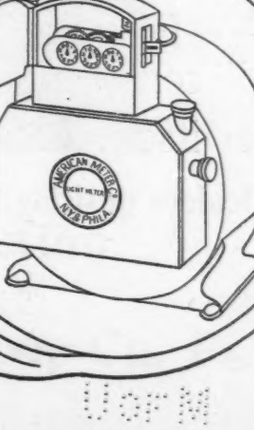
TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45









Welsbach Patent Sustained.

INJUNCTION GRANTED.

Judge Townsend, in the United States Circuit Court for the Southern District of New York, has handed down a decision sustaining the Welsbach Light Company's Rawson patent, and adjudged **THE SUNLIGHT INCANDESCENT GAS LIGHT COMPANY** to be an infringer. This Company has been enjoined from the further use of its method of manufacture of incandescent mantles or the sale or use of the same, and ordered to render an accounting.

A further decision has been handed down by Judge Lacombe in the United States Circuit Court, granting a motion for a similar injunction against **THE REX INCANDESCENT LIGHT COMPANY.**

Every other manufacturer of incandescent mantles in the United States is under these decisions an infringer of this patent, and the Welsbach Light Company will proceed against them at once.

We again caution gas companies and the public generally against the purchase of any incandescent mantle other than that made and sold by the Welsbach Light Company or its agents.

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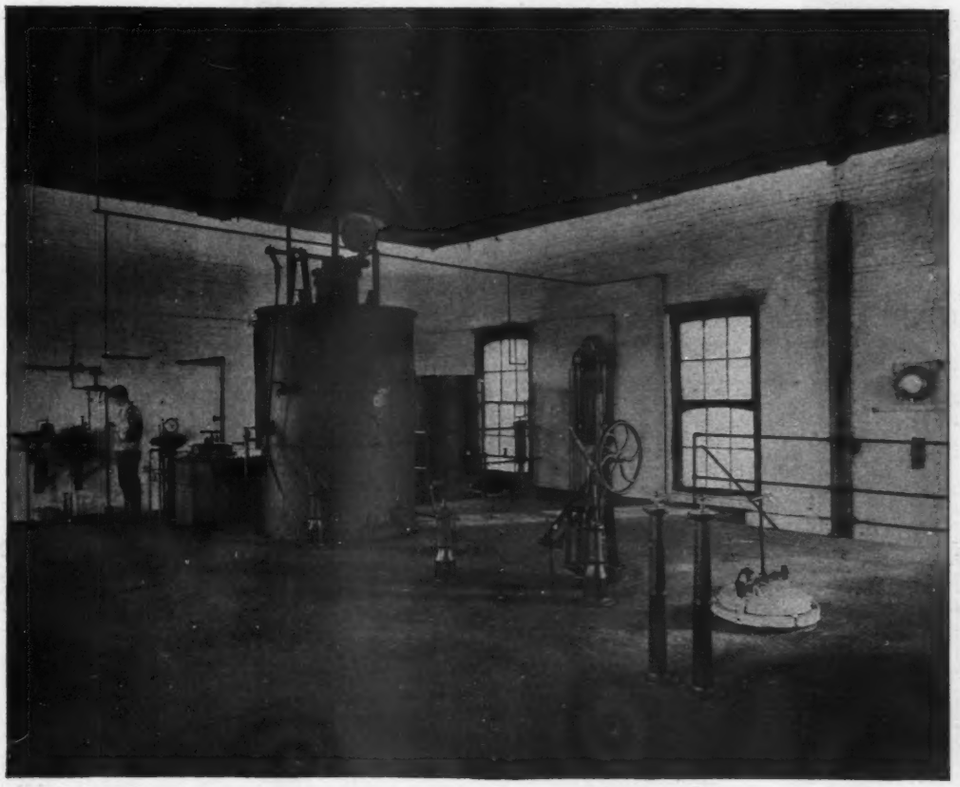

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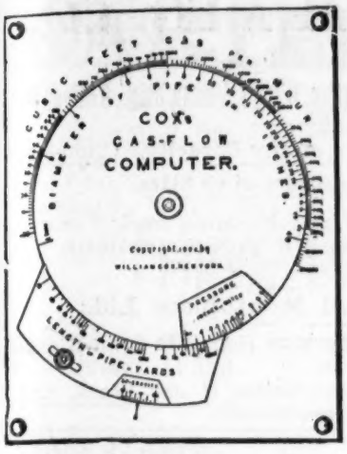

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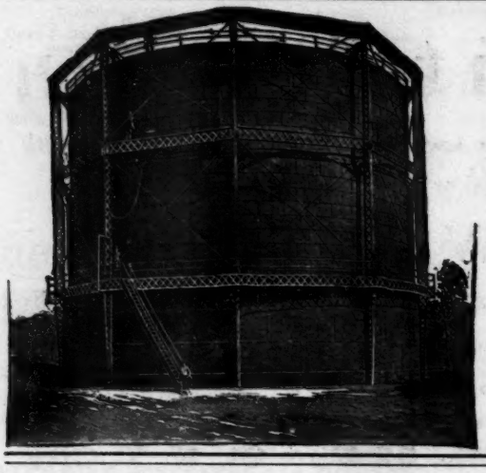

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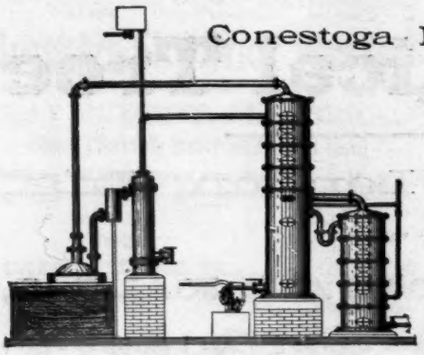

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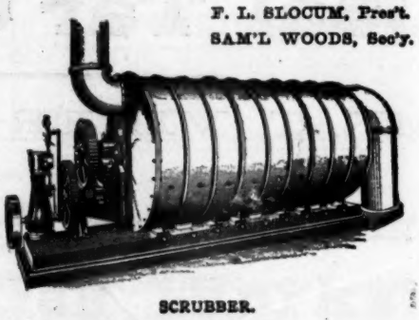

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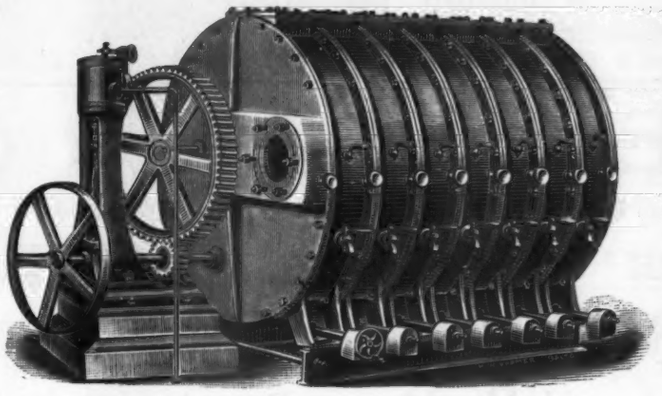

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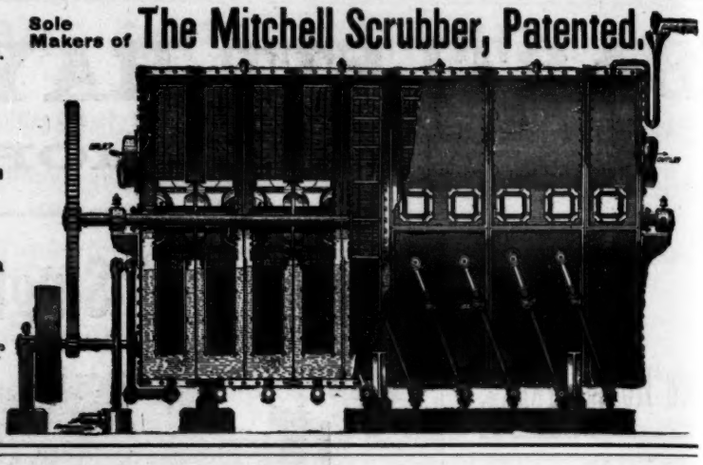

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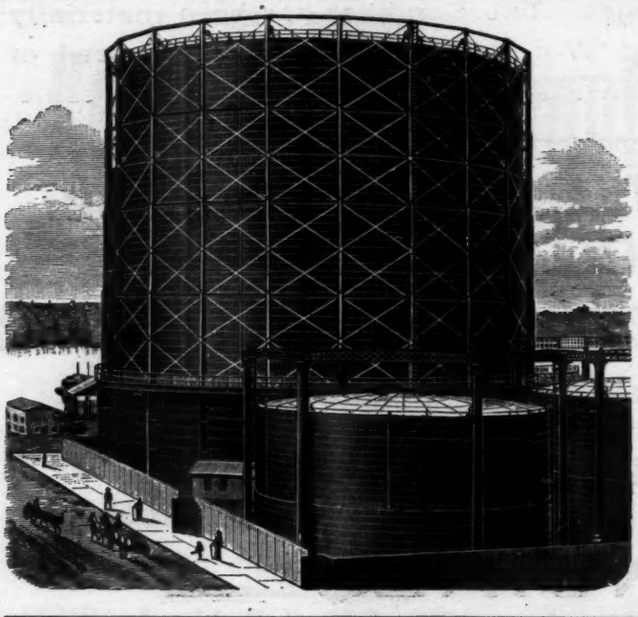

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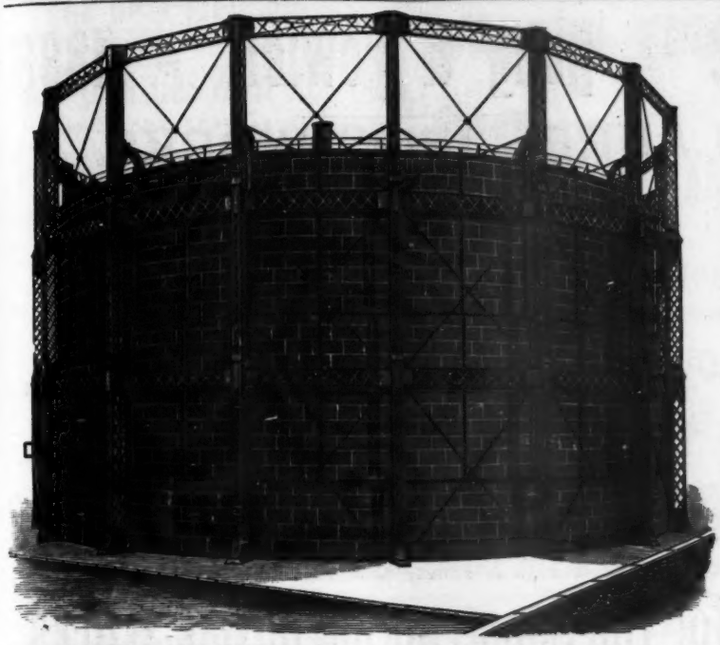

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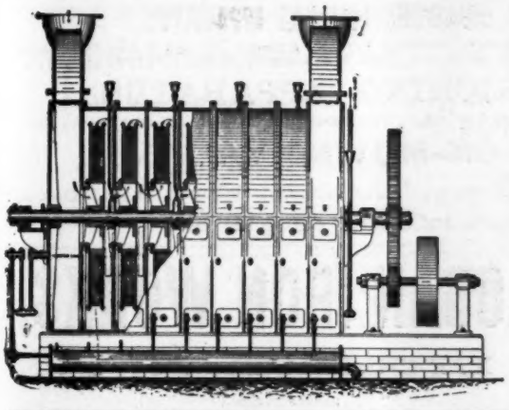

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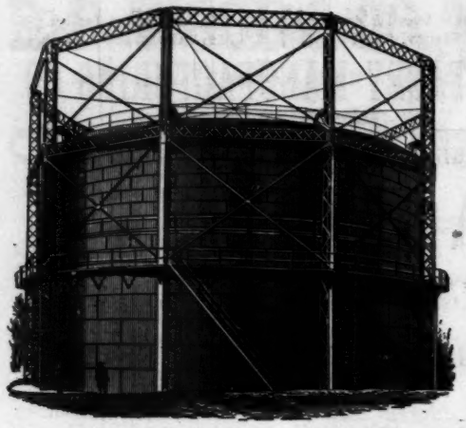

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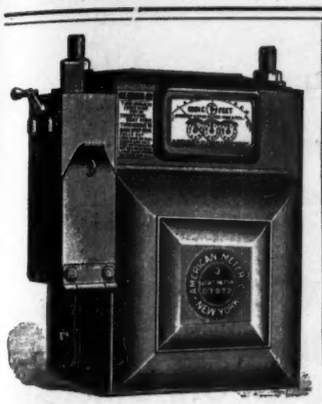

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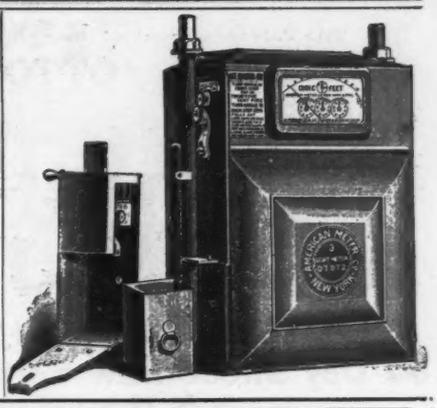

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